



Towards a greener labour market: occupational health and safety implications

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Abstract

Background. Climate change and environmental degradation are seriously jeopardizing the future environmental and economic sustainability at the global level prompting urgent calls for a shift towards more sustainable development and greener economies. The use of the so called *green jobs* is a key strategy to overcome economic and ecological crisis. **Aim.** The present study discusses the implications for employment and decent work of green jobs in order to identify information/training measures to enhance skills of employees protecting their working conditions.

Results. Despite all the emphasis laid today on the green economy, occupational health and safety (OHS) issues have still been talked only limited, as already noted in previous studies and literature reviews.

Conclusion. It is needed to assess traditional and new OHS risks within green jobs in order to facilitate the transfer of OHS knowledge to green technologies as well as identifying OHS training needs.

Key words

- green economy
- green technologies
- occupational health and safety
- emerging risk

LABOUR MARKET IMPLICATIONS OF ENVIRONMENTAL AND CLIMATE POLICIES

In accordance with the principles of the United Nations Framework Convention on Climate Change (UNFCCC) as set out in its article 3, paragraph 1, "Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common responsibilities and respective capabilities" [1]. The UNFCCC has identified two responses to the global warming: mitigation and adaptation to the effects of climate changes.

Adaptation refers to adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It refers to changes in processes, practices, and structures [2-4]. Countries with limited economic resources, low levels of technology, poor information and skills, poor infrastructure, unstable or weak institutions, have little capacity to adapt and are highly vulnerable [5].

"Mitigation" [2], on the other hand, refers to those actions aimed at reducing the emission of greenhouse gases (GHGs) and achieving the stabilization of their concentrations in the atmosphere at a level that would maintain the global warming under "sustainable" and

predictable values. Mitigation policies include tax disincentives for fuels with the greatest environmental impact, promotion of renewable energy, enhancement of power efficiency of cars and building sectors, development of agricultural policies promoting the use of bio-fuels etc.

From a broader perspective, green policies affect labour market outcomes through many channels, creating various structural adjustment pressures that interact with each other in complex ways:

- a new paradigm for energy production: as carbon pricing is introduced or further developed, it will cause important changes in relative prices within the energy sector that will result in the emergence of a new and more sustainable energy-mix;
- a new paradigm for consumption: substitution of energy intensive goods and services with more environmental-friendly ones;
- a new paradigm for innovation: research and development (R&D) investments in a number of economic areas will encourage technological innovations related to the production and use of clean energy;
- new macroeconomic conditions: carbon pricing acts as a tax on production activities, and therefore, will tend to reduce economic efficiency and cause gross domestic product (GDP) loss at least in the short and me-

dium run. On the other hand, the induced technological changes will help restore economic efficiency even though they will take time to materialize [6-8].

Over the last decades, different economic models have been developed with a view to analyze the economic impacts of “green” policies and the labour market implications associated with the transition towards a green economy. Most of these models agree that climate change and mitigation policies will have a substantial impact on the level, distribution and quality of work in the short and medium term; however, an accurate prediction of these dynamics still remains a big challenge due to the interactions of many factors such as the lack of detailed information and the uncertainty in defining the extent to which the demand will be affected by the increase in the production of “clean” technologies.

Investments in sustainable sectors will result in an expansion of production and the generation of a high rate of direct employment. Expanded production invariably leads to a higher market demand, resulting in an increase in indirect employment in supplier industries. The increased consumer spending of the latter will also result in further downstream employment [9, 10].

A number of studies carried out at both global and national level have shown that the impact of environmental regulations on the labour market is positive. The outcomes of such studies obviously are influenced by the methodology employed, the specific characteristics of countries under investigation and data that have been used [11].

The Organization for Economic Co-operation and Development (OECD) has developed a computable general equilibrium model (ENV-Linkages) to monitor how climate-change mitigation policies may affect labour market outcomes. Major impacts of climate-change mitigation policies on the labour market will affect the labour sectoral reallocation with fossil fuel industry dropping sharply and renewable energy recording its highest increase [12].

The vast majority of jobs directly generated by the environmental sustainability are either in primary economic sectors such as agriculture and fisheries or in typically low-paying, strenuous and dangerous sectors such as construction industry, recycling and waste management. There are no certain data confirming that the transition from traditional to renewable energy has determined an improvement in OHS issues. As for income effects, the general view is that the green growth will disadvantage certain categories of persons [13].

Greening is associated with the development and application of new technologies that require new skills and often offer better working conditions for employees developing or applying them. Evidence shows that job quality may be particularly positively affected for higher-skilled jobs [14].

GREEN JOBS PROMOTION

In occasion of the World Conference Rio+20, the world leaders, together with the thousands participants coming from Governments, private sectors, non-governmental organizations (NGOs) and other groups,

besides the renewed political commitment to guarantee a sustainable development, identified the green economy as a new solution to both traditional challenges for development represented by poverty, malnutrition, economic stagnation and to all new global threats represented by climate change and environment deterioration, as clearly evicted by the constant reference to them in the final document of Rio+20 [15].

Moreover, the new Europe 2020 strategy adopted by the European Council in June 2010, points out the climatic changes and the pressure on resources as the long-term big challenges to be faced, together with globalization and ageing. Such strategy calls for the Member States of the European Union (EU) to aim to a sustainable growth “... separating the economic growth from the use of resources, building up a sustainable and competitive economy, targeting the development of new processes and technologies, including green technologies”.

Member States should improve the entrepreneurial climate, foster the creation of *green jobs* and help enterprises renew their base industry. To this goal, the 2020 Strategy fixes the following objectives: 20% reduction of GHGs emissions, an increase up to 20% of the energy saving and 20% increase of the energy consumption from renewable sources [16].

During these last few years people have been talking and still talk about green jobs more from a statistic and numeric viewpoint than qualitative and contents one; to thoroughly understand the subject, though, a clear definition of what green jobs are is needed.

In 2008 the United Nations Environment Programme (UNEP), the Agency of United Nations specialized in environmental protection, referred to them as “work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality” [17].

More specifically, these jobs are giving a substantial help in keeping and restoring the quality of the environment, especially in the area of the renewable energy production (wind energy, solar photovoltaic, solar thermal, hydroelectric, geothermal and biomasses). For each of these areas it is possible to identify several activities as well as professional profiles, given the diversity of the human involvement in the production processes and the specific professional skills required.

“Green” also refers to those jobs concerning research and development of new technologies, bio-products production, energetic efficiency, correct waste management (e.g. collection, treatment and disposal). The new jobs in the environment-friendly and energy efficient construction industry are considered “green” too.

It is quite clear that the phenomenon of green economy (which is so pervasive to affect economical, technological and normative aspects) is having a huge impact on the job market as well. Such impact is both quantitative and qualitative, especially in Italy given the condition of the industrial field, the ongoing economical crisis but also the “blossoming” of this sector which is still new and still not “digested” by the economical system. In particular, five macro-effects can be outlined: a)

new professional profiles will be created; b) several jobs will be replaced due to the transition from fossil fuels to renewable energy; c) some jobs can be eliminated without replacement; d) many existing jobs will be just converted/re-qualified; e) new enterprises will appear on the market [18-20].

At global level, in 2014, an estimated 7.7 million people worked directly or indirectly in the renewable energy sector (19.1% of global final energy consumption in 2013), with an additional 1.5 million in large-scale hydropower. Liquid bio-fuels, biogases, biomass is the largest employer, with 2.9 million jobs. Solar photovoltaic (PV) is the second largest employer, with 2.5 million jobs, most of which are concentrated in China due to its undisputed lead in manufacturing as well as a rapidly expanding domestic market (Table 1).

In the EU, there were more than 1.2 million renewable energy jobs in 2013, the most recent year for which complete data are available for the region. Wind, solar PV, and solid biomass were the largest employers. Germany, France, Italy and Spain, together accounted for 60% of all renewable energy jobs [21].

In Italy, in 2013, the workers within the renewable energy sector were approximately 64 000. These estimate refers to both workers who are directly involved in the supply chain of the different described technologies (direct employment) and those indirectly involved in other working sectors (indirect employment). Solar PV generates the greater impact on employment, 39% of the total (approximately 24 900 employees). Bio-energies are ranked second in terms of employment, with approximately 13 800 workers (22%), followed by the wind power with 5300 employees (8%) and the mini-hydroelectric (3200 employees) and geothermal (1100 employees) sectors with an overall percentage of 7% [22]. The will of the companies to invest in *green jobs* is also confirmed by a larger adoption of permanent employment contracts for these kind of professional profiles [23].

Table 1
Estimated employment in the renewable energy sector – Selected countries and World (2014)

Renewable energy source	World	Selected countries	
Wind energy	1 027 000	China	502 000
		USA	73 000
		India	48 000
		Brazil	36 000
Solar PV	2 495 000	China	1 641 000
		Japan	210 000
		India	125 000
Solar thermal	764 000	China	600 000
		India	75 000
		Brazil	41 000
Biofuels, biomass, biogas	2 991 000	Brazil	845 000
		China	521 000
		USA	434 000
Total	7.7 million (including geothermal and hydroelectricity)		

Source: International Renewable Energy Agency, 2015.

Despite these new opportunities, the low female presence in the labour market remains an open issue in most EU countries. The share of women employment in the renewable energy sector is extremely low, also due to the request of professionals profiles (engineers and technicians) in which females are traditionally under-represented [24].

According to the Women in Renewable Energy Sector (WiRES) project the possibility of a very damaging gender discrimination may subsist, especially in the renewable energy sector, which is one of the most dynamic in green economy [25].

Especially the long term unemployed women may be the ideal candidates for training opportunities (to be promoted by both local authorities and corporations) which would be crucial for the transition towards a more inclusive process of jobs transformation and to guarantee equal opportunities to access the labour market.

Few studies have been conducted on this issue, but it's clear that the number of women at the helm of green companies is still very low. They are much more involved in tourism and services sectors than in agricultural and industrial ones. According to a study carried out by the International Labour Foundation for Sustainable Development, on a global women are widely represented particularly in the account services (68%) [26].

HEALTH AND SAFETY RISKS IN THE RENEWABLE ENERGY SECTOR

The large majority of the global workforce works under "vulnerable" conditions, lacking of adequate health protection and social welfare benefits. According to the latest ILO estimates, approximately 2.34 million work-related fatalities still occur in the world each year. However, only three thousand deaths (14% of the total) are related to occupational accidents. The vast majority, over two million, with an average of 5500 cases per day, is due to a wide range of occupational diseases that also affect over 160 million workers per year with no lethal outcomes [27].

Accounting for these estimates and the heavy burden placed on the society in terms of work-related injuries and occupational diseases, great importance has been given to health and safety (H&S) at social, public and organizational level, also considering the fundamental changes the world of work is witnessing.

Longer working hours, shift work, temporary work are becoming more and more common all the time. Workforce is changing too, due to ageing, increased ethnical diversity and a higher involvement of women in the labour market [28].

Furthermore, technological and social transformation as well as the globally changed economic conditions are not only worsening the hazards posed to human health but they are also responsible for new and emerging risks. This intersects with a new vision of man as agent and main player in the environmental changes within a deep cultural transition affecting the concepts of health, wellbeing and disease. An increased awareness of the mutual interaction of different factors is substantiating the principle that wellbeing and productivity are strictly interdependent [29].

Occupational diseases and injuries can generate human, social and economic costs affecting different and large subjects, including workers, organizations, insurance companies, health and welfare systems.

ILO has estimated that 4% of annual global GDP, or US \$ 2.8 trillion, is lost due to the direct and indirect costs of occupational accidents and diseases, including lost working time, workers' compensation, interruption of production, and medical expenses [27].

Nowadays, the importance of health promoting workplaces is being more and more acknowledged as appropriate or even essential. New legislative initiatives have started to address this issue, reflecting the need for organisations to develop, at international level, a new competitiveness paradigm which encompasses the cost-effectiveness of workplace health promotion investments and actively supports actions of improvement of the organization's overall quality.

Workers' benefits are notable and measurable and translate into a reduction of occupational risk factors, an increased workers' health, higher levels of job satisfaction and an overall improvement of quality of life. In this scenario, small enterprises face specific problems: the economic restrictions of organisations with less than 50 employees are usually broad and considerably hinder their commitment to improve health and safety at work.

The transition towards a green economy with a strong emphasis on innovation highlights the importance of anticipating new and emerging risks for the new green jobs, to ensure fair, safe and healthy working conditions [30, 31].

However, H&S practices and policies all too often focus on the management of existing risks and problems, whereas the need for forecasting efforts to "anticipate new and emerging risks" was already identified within the framework of the Community Strategy 2002-2006 and reaffirmed by the following Community Strategy 2007-2012 which stressed the need for improvement in the prediction of such risks [32, 33].

The use of environmentally sustainable technologies and productive processes may represent a serious challenge to the workers' health and safety, although it is a forced choice to answer to the major challenges related to climate changes and to the need for a new economic asset based upon sustainable criteria.

In green jobs, workers who are about to take the road to the booming green industry may not be aware of the traditional risks that are already known in the workplace (physical, chemical, biological risks etc.). Moreover, workers could be exposed to new hazards linked to the introduction of new technologies (e.g. nanotechnologies), new substances and new models of work organization [34, 35].

In the photovoltaic sector, for example, H&S risks affect the whole lifecycle of every plants: design and planning, manufacture, transportation, installation, integration with the infrastructure, dismantling, disposal/recycling. In manufacturing of PV cells, workers' health may be adversely affected by a variety of chemicals and materials. Particularly hazardous in the manufacture of cells are caustic chemicals such as hydrofluoric acid (HF) employed to clean silicon wafers, and silane gas

(SiH₄) which is extremely inflammable and explosive. In the field of new generation PV cells, based on cadmium telluride, the major hazard is the toxicity and carcinogenicity of cadmium.

During installation, maintenance and dismantling, the main hazards are associated with working at height and include: access issues; falling objects; falls, slips, and trips caused by slippery glazed tiles or tiles with algae or moss deposits on roof surfaces; large roof pitches; fragile roofs; and brittle or damaged roofing.

In addition to the risk of injuries from slips, trips and falls, also musculoskeletal disorders (MSDs) may be frequently observed due to an increase in loads handling and ergonomic risks. Adverse weather conditions such as extreme temperatures increase the risks of cold or heat stress. Exposure to sun radiation may lead to sunburns, eye disorders and certain types of cancers [36].

In the wind energy sector, workers are potentially exposed to resins, styrene and solvents, harmful gases, vapors and dusts, or physical risks associated with manual handling during the blade manufacture and maintenance processes. Dust and fumes from fiberglass, hardeners, aerosols and carbon can cause common health-related problems including dermatitis, dizziness, drowsiness, sleepiness, liver and kidney damage, blisters, chemical burns and effects on the reproductive system. Physical risks during maintenance include: fall from height, musculoskeletal disorders caused by manual handling, discomfort while working in confined spaces, physical efforts during mast lifting operation, electrocution, injuries caused by contact with moving parts and falling objects. Furthermore, workers could be exposed to fires due to electrical equipment, combustible materials or lubricants used during the construction phase of a turbine [37]. Below are the major H&S risks in renewable and traditional energy sectors (Table 2).

The project "Foresight on new and emerging risks associated with new technologies in green jobs by 2020" [38] carried out for the European Agency for Safety and Health at Work (EU-OSHA) describes three scenarios for evaluating the OHS implications of new and emerging technologies in a "changing world", taking into account the scientific, societal and economic context:

- *Win-win (high economic growth and strong green values)*
In a buoyant economy, funds are available for OHS investments, but the high pace of innovation and the rapid roll-out of new technologies and new products, as well as the creation of new jobs requiring new skills mean that a wider population may face new risks over shorter timescales. It is, therefore, important that OHS assessments are undertaken early in the development cycle of a technology or product so that the pace of development doesn't leave OHS behind.
- *Bonus world (high economic growth and weak green values)*

In a healthy economy, even though funds are available to invest in OHS and make infrastructure and business processes safe, OHS has a relatively negligible importance for many governments, while employers consider the impact on corporate profits more than the positive effects of a good OHS system on productivity.

Table 2
Occupational health and safety in renewable energy sector

Renewable energy source	Occupational hazards/risks
Wind energy	falls from heights unfavorable microclimate conditions (e.g. high temperature) musculoskeletal disorders (owing to manual handling of loads, awkward postures, etc) electrocution chemical risks (e.g. exposure to resins, styrene)
Solar PV	falls from heights electrocution unfavourable microclimate conditions musculoskeletal disorders (owing to working in confined spaces) exposure to toxic chemicals and nanomaterials (e.g. cadmium telluride, amorphous silicon, silicon tetrachloride) burns and explosions
Solar thermal	falls from heights electrocution burns unfavorable microclimate conditions
Bioenergy, biomass, biofuel	fire and explosion biological risks (e.g. exposure to hazardous volatile organic compounds -VOC, dusts and endotoxins) exposure to carcinogens, heavy metals and gases oxygen depletion
Geothermal energy	falls from heights electrocution emissions of substances such as sulfur, silica, arsenic and mercury hazards/risks due to some activities: trenching, excavation (e.g. noise, vibration) hazards/risks associated with borehole drilling, piping steam/hot water
Hydroelectricity	falls from heights electrocution chemical risks hydrogeological risks

Source: European Agency for Safety and Health at Work, 2013.

New jobs and new products are bringing new hazards, and the rapid roll-out of new technologies means that a wide population is exposed to them within short timescales. As in win-win, there are skills shortages associated with the high pace of innovation.

- *Deep green (low economic growth and strong green values)*

Low economic growth has tempted employers to cut corners, making investment in safer and healthier infrastructure more difficult. A tendency towards decentralized, more local and smaller enterprises (in particular microenterprises and self-employment) makes it more difficult to reach workplaces to disseminate good OHS practices and to control OHS conditions. A slower introduction of new technologies and products offers more time to understand and assimilate new risks and hazards, on which updated training will be needed especially in newborn green enterprises.

INAIL RESEARCH IN THE FIELD OF GREEN JOBS

The Department of Occupational and Environmental Medicine, Epidemiology and Hygiene (DiMEILA) of the Italian Workers Compensation Authority (INAIL), as a WHO Collaborating Centre, aims at pursuing WHO's objective on workers' health protection in the field of green economy, as outlined in the Global Plan of Action on Workers' Health as a testimony of the growing relevance of this OHS issues [39]. To this

end, taking as its starting point the EU-OSHA study [38] and the previous INAIL investigation on nanotechnologies [40], in 2013 the Department started a consultation process with some key Italian stakeholders (i.e. social partners, institutions, green businesses and national experts) to gather their perceptions of the potential effects of green jobs on OHS, with particular regard to the renewable energy sector. The research has been developed in two phases.

Phase 1: INAIL Survey "Stakeholders' perception of the possible implications of green jobs for health and safety at work in Italy"

The survey, started in May 2013 and completed in March 2014, analyzed the perception of the potential impact of the transition to a green economy on OHS. This phase involved the administration of an online questionnaire to a representative sample of 61 Italian stakeholders belonging to different categories (institutions, employers' organizations, businesses, trade unions, research). In all, 34 questionnaires were completed, giving a response rate of 55.7%. As regards the aspects considered fundamental for a fair and equitable transition towards a green economy, sustainable development ranked first (30.1% of responses), followed by investments in research (29.0% of responses), while only 10% of respondents considered OHS aspects significant. As regards the answers, it is worth noting that

only 12.7% of the sample believed that renewable energies – when compared to traditional energy sources – entailed new risks that could not be managed with current risk management approaches. The majority of responders (38.2%) affirmed that these new risks can in fact be managed with current procedures; another 27.3% of responders thought that renewables entails the same types of risks as traditional energy sources which, anyway need new risk management procedures. Looking at OHS risks associated with various sustainable energy sources, wind, solar photovoltaic and solar ther-

mal energy (41.2%) entailed low health and safety risks. Medium risks were identified for geothermal (47.1%), hydroelectric (44.1%) and biomass (38.2%) (Figure 1).

The prediction of OHS risks during planning and ad hoc risk management system were considered the main measures to be taken to safeguard health and safety of green sector workers (Figure 2).

This survey can be considered, as opposed to what emerges from the analysis of national literature, an objective analysis of the perception about an emergent aspect – and yet so little studied – namely the possible

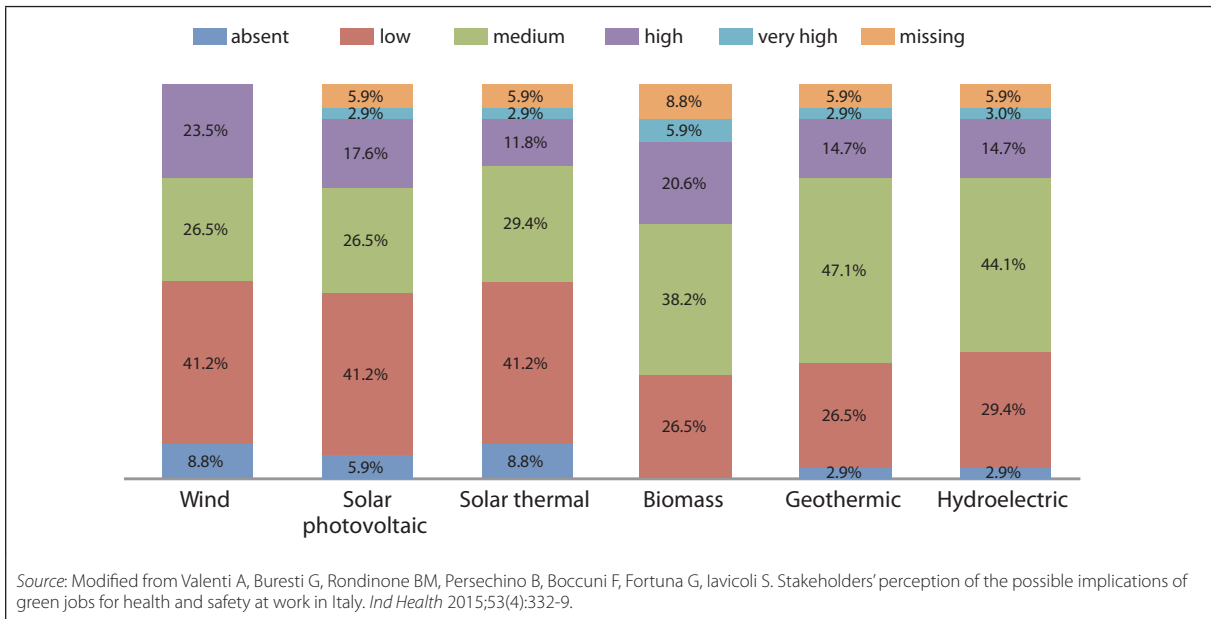


Figure 1
Perception of the level of risk for workers' health and safety in renewable energy sectors.

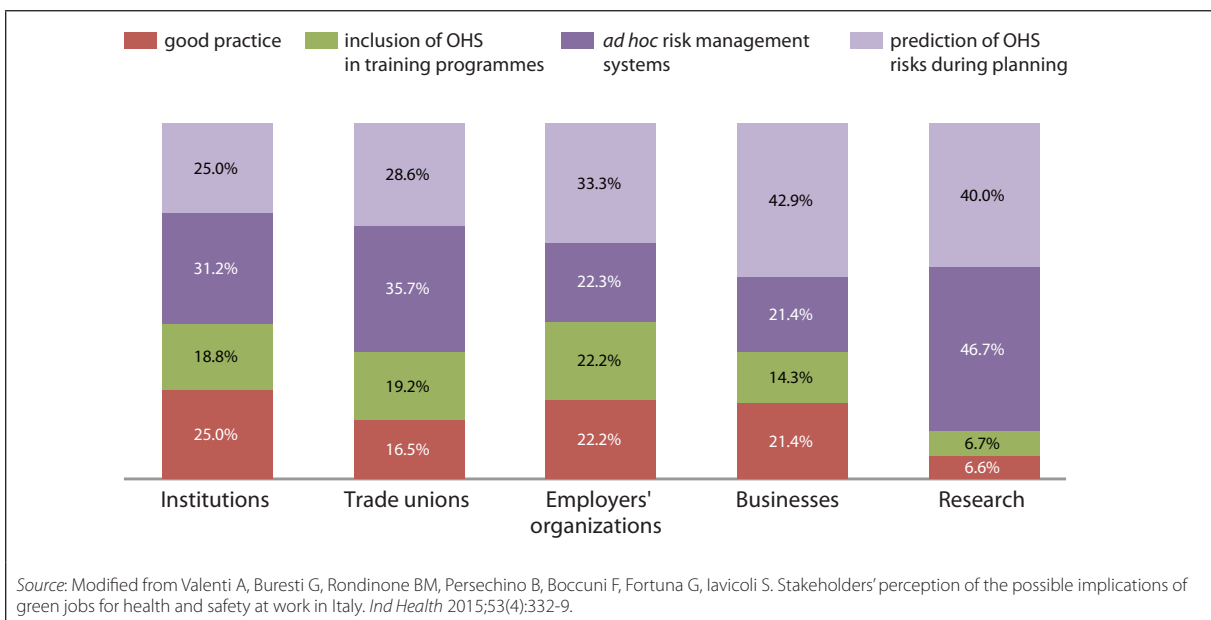


Figure 2
Main measures to be taken to safeguard the health and safety of green sector workers.

implications that the introduction of green technologies could have for the health and safety of workers. To this end, the choice of a sample as representative as possible of the individual categories directly or indirectly involved in the issue under study, helped to give the study a greater scientific value. This brought to light quite clearly the main critical points as regards the OHS implications of green work, and pointed to the principal policies to be adopted to safeguard working conditions [41].

Phase 2: INAIL Workshop “Workers’ health and safety protection in renewable energy sector”

During the Workshop, the stakeholders involved in the first phase have been asked to spot out issues and develop strategies related to three different types of policy tools:

- rules: voluntary or mandatory laws setting limits, procedures and standards to be adopted;
- active policies: interventions aimed at sustaining the development of knowledge and tools to implement efficient support systems in order to promote the definition and implementation of laws and/or good practices;
- communication and information: interventions aimed at spreading clear and transparent information to raise awareness on risks, good practices and opportunities.

The Workshop focused on health and safety risks for workers along the different phases of the production cycle (starting from R&D to waste disposal) considering the most important technologies for the production of renewable energy (wind energy, biomass, geothermal, hydroelectric, solar thermal and solar PV).

In the first session, in order to clearly outline issues from all the different point of view, participants have been divided in three working groups representing the main categories of stakeholders: “Enterprises”, “Workers” and “Institutions and Research”). Each group was invited to outline the main occupational risk factors in the renewable energies sector and the needs of specific policy interventions to ensure an adequate workers’ health and safety protection. Furthermore, starting from the outlined risk factors, were asked to spot out the main barriers to their correct and efficient management, including legislative, technological, cultural or

economic factors that may have an impact on workers’ health and safety protection.

In the second session, participants, notwithstanding their background, have been divided into three new groups (“Rules”, “Active policies”, “Communication/Information”) and were asked to elaborate proposals and solutions to overcome the barriers previously outlined. Hereby follow the main possibilities spotted out by each single group. Among proposals put forward by the groups, the preparation of national guidelines, integrated with regional interventions and the certification of competences of green workers are the most widely shared by participants (Table 3).

CONCLUSIONS

A healthy workforce is a prerequisite for social and economic development as well as for productivity. Protecting the health of the workforce through access to decent jobs, universally available health services, and social health protection contributes both to sustainable development and worker’s productivity. Ensuring that all jobs, including the green ones, are decent, safe and healthy works is essential to improve the quality of workplace environments. In fact, on the one hand, the green economy calls for a substantial change in the world of work and the creation of new green jobs and skills in all sectors in order to redirect the production systems, consumption patterns and society as a whole towards “decarbonization”, protection of ecosystems, waste reduction and pollution prevention; on the other, due to the crisis we are currently facing, it is clear that social protection, creation of new jobs, improvement of working conditions and the respect for workers’ rights are fundamental elements of a sustainable, equitable and inclusive growth paradigm.

However, despite great emphasis has been placed today on the green economy, OHS issues still remain scarcely addressed, as already stressed by previous studies and research [30, 31]. Accordingly, INAIL survey underlines the scarce perception of these issues in relation to a fair and balanced transition towards a green economy due probably to a delay of the Italian political, scientific and industrial world in the assessment of potential risks for workers’ health and safety posed by the

Table 3
Priority proposals

Proposal	Businesses	Workers	Institutions and Research	Total
Development of national guidelines integrated with the experiences of the regional context	9	5	2	16
Worker skills certification	1	4	3	8
National database for the monitoring of accidents based on INAIL data collection system	4	2	1	7
Newsletter for OHS professionals and small and medium enterprises (SMEs) focused on OHS in renewable energy sector	1	1	-	2
School – work training programmes	-	1	1	2
Information campaign on OHS in renewable energy sector	-	2	-	2

introduction of new green technologies.

These findings highlight the need for systematic assessment of the OHS factors involved in any new technology, new product or development process, not only in the early stages but throughout its lifespan; this comprises planning, manufacture, transport, installation, operation, maintenance, demolition and disposal, etc. It will also be essential to foster regular contact between the various disciplines and social partners, so as to ensure OHS is properly integrated into innovative and technological developments, and to generate further knowledge and new skills with a view to identifying future challenges better and the related OHS requirements [41].

Active OHS policies in the green sector appear fundamental not only for designing and implementing rules concerning OHS issues but also for promoting concrete prevention and protection actions at the organizational level based on risk management and hazard analysis/elimination criteria.

Social dialogue, collective bargaining and tripartism represent suitable tools to generate new political ideas at all levels. Social dialogue can be a solid basis since it benefits from employers and employees participation in joint actions with governments which is key factor to a successful transition process.

The way forward a safe job is possible through three categories: research, education and policy. In the research area, for example identifying hazards in new green technologies and investigating design alternatives. In terms of education and training by incorporating occupational safety and health in professional curricula, textbooks, accreditation, and certification examinations or by specific training programme. The promotion of OHS culture, and education and training will play a decisive role in boosting awareness of the conditions for health and safety of green workers. Moreover, it seems to be the decisive promoting a culture of health and safety and education and training in order to increase

the protection of the health and safety of workers green.

The highest priority issue for practice involves the widespread sharing of good practices. Policy recommendations include the development of consensus standards with consideration of occupational safety and health, partnerships among health and safety professionals, designers, business owners, labour, environmentalists, insurance companies, and government. This process requires multidisciplinary input not only from OHS experts.

Author's contribution statement

All authors contributed equally to this work. Antonio Valenti and Diana Gagliardi designed the work. Antonio Valenti collected and analysed the data and interpreted them together with the other authors. Antonio Valenti, Grazia Fortuna and Diana Gagliardi wrote the manuscript. Sergio Iavicoli and Diana Gagliardi reviewed the manuscript. Lastly Sergio Iavicoli approved the final version of the manuscript to be published. All authors discussed the results and implications and commented on the manuscript at all stages.

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