Foresight of new and emerging OSH risks associated with new technologies in green jobs by 2020

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Located in Bilbao, Spain, EU-OSHA acts as a catalyst for developing, collecting, analysing and disseminating information that improves the state of occupational safety and health in Europe. The Agency is a tripartite European Union organisation and brings together representatives from three key decision-making groups in each of the EU’s Member States – governments, employers and workers’ organisations.
Background to EU-OSHA

“The European Agency for Safety and Health at Work (EU-OSHA) is committed to making Europe a safer, healthier and more productive place to work. We promote a culture of risk prevention to improve working conditions in Europe”

Achieved via:

- Campaigning
- Prevention
- Partnership
- Research
The aim of the EU-OSHA’s European Risk Observatory (ERO) is to identify new and emerging risks in OSH and to provide a basis to set priorities for OSH research and actions in order to improve the timeliness and effectiveness of preventive measures.

To achieve this aim, the ERO provides an overview of safety and health at work in the EU, describes the trends and underlying factors, and anticipates changes in work and their likely impact on OSH.
ERÖ’s 3 dimensions

PAST

PRESENT

FUTURE

- Medium-term, Delphi-studies:
  - Four expert forecasts on: physical, biological, psychosocial & chemical emerging risks
  - Followed up with specific literature reviews
- Foresight:
  - 2010-2011: a 10-year foresight: “impact of technological innovations on OSH”: green jobs
Foresight of new and emerging OSH risks
Why in green jobs?

- OSH Community Strategy 2007-12 + strategic framework 2014-20:
  EU-OSHA to anticipate risks associated with new technologies

- Green jobs: strong emphasis on innovation

- A growing sector: over 1 million new jobs by 2020
  - Europe 2020 Strategy: 20% decrease in CO2 emissions, 20% increase in renewable energy, 20% increase in energy efficiency
  - Solar, wind and biomass energy experience the most rapid employment growth
    - EU Wind energy: +30% jobs between 2007-10; +50% expected between 2010-20
    - EU: 300,000 jobs linked to biomass fuel production by 2020
    - FR: 600,000 green jobs by 2020

⇒ Potential to affect many workers if green jobs are not safe
⇒ Green jobs will be sustainable only if safe, healthy and decent
⇒ Opportunity to anticipate new risks before they appear
Implementation: 3 phases

- **PHASE 1: Key drivers of contextual change that could shape green jobs**
  - Review + consolidation (interviews + web survey) + selection (e-voting)
  - Climate change, economic growth, public attitude, energy security, demographics, etc.

- **PHASE 2: Key new technologies likely to impact on OSH in green jobs**
  - Review + consolidation (interviews + web survey) + selection (workshop)
  - Wind energy; bioenergy; waste management; construction; transport; manufacturing; decentralised energy production & transmission; energy storage; nanomaterials.

- **PHASE 3: Scenario-building**
  - Production of “base” scenarios with the key drivers
  - Eight technology workshops to produce the “full” scenarios
  - Policy workshop: to test the scenarios as a tool to explore future OSH issues & policy option to address them

⇒ **Over 170 people were involved!**
Three base scenarios

- **Economic growth:**
  - external impact of global growth
  - and growth in Europe

- **Green values: willingness of**
  - people and organisations to change their behaviour
  - governments to implement regulatory and fiscal policies to promote green activities

- **Rate of innovation:**
  - overall
  - in green technologies in particular
'WIN-WIN' - Context

Economic growth

Holistic human development

Green values

Strategic investment & rebuilding

Green innovation

Green = growth = prosperity

Other innovation

New frontiers & new applications

http://osha.europa.eu
‘BONUS WORLD’ – Context

Economic growth

Green values

Green innovation

Other innovation

Heading for the sky

Negative outlook

Only where profitable

Hi-tech business is booming

http://osha.europa.eu
DEEP GREEN’- Context

Economic growth

Money is not top priority

Green values

Abundance & diversity

Green innovation

For a green future

Other innovation

Not a priority in itself

http://osha.europa.eu
Wind Energy
‘WIN-WIN’ – Wind Energy

<<Delta Charlie to Base... I repeat... Storm force winds are forecast... Returning to the accommodation platform...>>

“I wish the Green Job Policy Team was here. They would then appreciate the challenges of working on these large turbines in this environment”
‘BONUS WORLD’ – Wind Energy

... relaxed planning rules allow large energy companies to put turbines on apartment blocks...

“Think about the profit we will make with these... they could not be more cost effective.”
“Look at that turbine – way beyond its design life!! We can only get refurbished spare parts these days...”

“It is exhausting to spend all day climbing up these old turbines without lifts... I wish we had new ones”
OSH hazards in the wind energy sector

- Access to remote areas
- Going up in the tower: Falls from height, MSDs
  - Tower height increases rapidly with innovation
- Electrocution – from the switching installation, electrical arcs
- Fire - e.g. if tower struck by lightning
- Maintenance in very windy conditions, rappelling down the blade or inside the blade in confined space, exposure to e.g. carbon fibres, machine related hazards
  - Regular maintenance ⇒ workers may be regularly exposed
- Blade failure (sections of up to 200kg thrown up to 1km far away)
- Blades can also throw ice
- Structural failures (HSE investigated 2 turbine collapses in 2007)
- Manufacturing: Exposure to e.g. epoxy resins, styrene; Work in confined space – ventilation, chemicals, MSDs
- Transport of big components
- Off-shore – additional risks: complex dives, cable laying, isolation, extreme weather, fall into water, splash from salty water

http://osha.europa.eu
‘WIN-WIN’ – waste

Our automated waste recovery extraction and intelligent re-use technology is the best available...

But how do we know if new kinds of hazardous waste are getting into new kinds of places ???

http://osha.europa.eu
‘BONUS-WORLD’ – waste

Have you thought about investing in automated landfill resource extraction & recovery?

Who needs to invest in automation when you’ve got all these cheap workers??
‘DEEP GREEN’ – waste

“Your waste is my resource” ...
(but these wheelbarrows get heavier and heavier...)

HEY – wish we knew what is being put in here!!
Waste treatment sector

- **One of the most hazardous occupations**
  - Accident (FR) and illness (DK) rate 2x average, infectious diseases rate 6x average (DK)

- **The risks posed to workers are linked to:**
  - nature of the waste (chemical and biological risks)
    - High level of dust, up to 100 VOCs, complex mixtures of airborne micro-organisms
    - E-equipment and end-of-life vehicles: lead, cadmium, mercury, PCBs, arsenic, PVC, Cr(VI), halogenated flame retardants
  - work process (noise, vibration, heavy/repeated manual handling, falls, cuts, MSDs, etc.)
  - work organisation (traffic, simultaneous activities, workload difficult to plan, etc.)

- **Growing quantity and diversity of waste: potential exposure to a large range of (new) materials**
  - Nanomaterials in waste will increase as their use becomes more widespread
  - Rapid innovation rate: new materials appear into waste before OSH can be considered
  \[\Rightarrow \text{Difficulties to identify its provenance and composition} \Rightarrow \text{better material labelling, tracking, controls}\]

- **High waste disposal charges may lead to more in-house waste treatment**
  - Risks shifting from professional waste operator to the waste producer (incl. micro- and SMEs) for example from small-scale bio-digesters, waste compactors or incinerators

- **Zero waste economy: dealing with the most difficult tail end of the waste stream**
  - E.g. in concentrated form (bioenergy waste, landfill mining) needing special handling
Green Buildings
‘WIN-WIN’ – construction

“Construction these days. Much less manual work.”

“Yeah - look at this one - carbon epoxy fibre laminated cement extrusion, with all services installed. Just hope the ‘plug and play’ water and electricity connections are clearly labelled.”
Hey, this tube of sealant says “extremely toxic and hazardous”... So why are we not using a safer one??

You better keep quiet if you want to keep your bonus...
‘DEEP GREEN’ – construction

This “retro-fit photo-voltaic” programme is a job for life!!

Just mind out for the unknown substances and fibres in your lungs... Or else you could just slip in the rain & fall off the ladder first.
Green building

- **Health impact of green construction materials**
  - New materials: nanomaterials, phase change, heat storage chemicals, aerogels, fibrous composites, etc. ⇒ prior health impact assessment needed
  - Renewables, e.g. wood, bamboo, straw, sheep wool, cork, paper flakes, flax:
    ⇒ dust, allergens, moulds, endotoxins and possibly chemicals
    - Flakes or flax wool impregnated with Borax: fire retardant, antimicrobial but reprotoxicant
  - Recycled materials:
    - Fly ash (PAH, cadmium, mercury, nickel, chromium) and asphalt (PAH) as filler in concrete
    - Steel from recycled metals containing lead ⇒ need for better material quality control
  - Trade off long-/short-term VOC emission: linseed oil based paints emitting terpenes
  - Sprayed shells as insulation materials: dust, high physical load, noise

- **Retro-fitting: dust, work at height, etc. – risks not new but in new situations**
  - Re-insulation of existing buildings: exposure to insulation materials, e.g. MMMF
  - US: isocyanate OEL exceeded when polyurethane foam insulation sprayed on roof

- **Lack of adequate ventilation in tight-buildings during indoor finishing work**

- **More manual work (2 to 3x more), e.g. waste separation & handling on-site**

- **More complex design elements more hazardous to construct (skylights)**

- **Higher incident rate in green-certified construction projects**
Solar Power
Small-scale solar applications

- “Construction” hazards combined with electrical hazards
- Manufacturing - involves large quantities of chemicals - many highly toxic
  - Solvents/acids to clean the semiconductor parts
  - Gases to deposit the ultra-thin layers of material
  - Metals, depending on the type of PV module
- Leaching hazard, including at the waste treatment stage
- Workers’ skills and training
- PV remains live even when the mains supply is cut - risks for emergency workers

Source: Electric Power Research Institute, 2003
OSH hazards linked to bioenergy

- Storage and handling of biomass expose workers to physical, chemical and biological risks and risks from fire and explosion
  - Biomass may not store well and produce hazardous VOCs, dusts, moulds and endotoxins
  - Biomass may self-heat due to microbiological processes
  - Explosion risk: small biomass particles can get airborne e.g. after size reduction prior to combustion/pyrolysis/gasification

- Biomass processes can involve the production/use of flammable gases/liquids at high pressures/temperatures, e.g. pyrolysis (350-550°C), gasification (+700°C)

- Toxic waste from biomass in concentrated form needing special handling
  - e.g. strongly alkaline ashes with heavy metals

- Biomass production/collection: agriculture and forestry work likely to intensify

- 3rd generation biofuels from organisms created by synthetic biology: biohazard?

- Variability of quality of biofuels, and of gas from biomass compared to fossil fuels
  - e.g. hazards from methane from biomass if injected into the gas grid

- New entrants to sector, e.g. from waste, agriculture, food, textile sectors, incl. SMEs
  - May lack expertise in operating biomass equipment + Quality of their products?
Decentralised generation of renewable energy

- **Speed of change and diversity of systems (wind, PV, solar, CHP, bio-digesters etc.)**
  - Skill shortages and competence issues: specific knowledge needed but not yet fully developed and old OSH knowledge/safe working practices not always directly transferable
  - Major work to upgrade the grid: 200 million smart meters installed in the EU by 2020
  - Possible increased live working to cope with rapid pace of change and massive installation
- **Distributed nature of the system and of the work** ⇒ challenge to reach workplaces, monitor and enforce good OSH practices
- **Difficulty in maintaining top down control of a complex (super smart) grid**
  - Two-way transmission with large diversity and number of energy providers connected ⇒ black-outs and live work
- **Diverse, distributed non-standard installations ⇒ hazard to maintenance workers**
  - Do-It-Yourself installations, cheap (counterfeit) components ordered online
- **New entrants extending beyond their original skills lacking risk awareness**
  - SMEs producing energy as 2ndary activity may have their own workers, or sub-contractors, install or maintain their renewable energy systems when not skilled for this work
- **Cost pressures, e.g. substitution of copper cabling with aluminium introduces an increased risk of sparking and joint failure**
OSH issues linked to energy storage

- **Hydrogen used as an energy carrier (incl. used as a fuel for vehicles)**
  - Transport and storage issues as it is difficult to handle
  - There are risks of fire and explosion and risks from its cryogenic liquid form

- **Interconnected mixtures of energy storage devices (incl. batteries, Compressed Air Energy Storage, flywheels, etc.), especially if assembled by DIY enthusiasts** ⇒ unexpected risks to installation, maintenance and emergency workers

- **Deep sea energy storage:** a relatively low-tech concept but involves high voltages and power levels in a complex environment ⇒ complicated installation and maintenance work

- **Batteries: fire, explosion, hazardous chemicals and electrical risks**
  - High temperature of sulphur and zebra batteries, high temperature and gas in gravel batteries
  - A large Sodium-Sulphur battery in a Japan wind farm caught fire
  - Well-known risks but will involve different people in different situations ⇒ False perception that new batteries are safe based on experience with lead-acid batteries
  - Batteries as building energy stores: people not aware of the risk of over-charging
  - Novel batteries bring potential health risks (e.g. carcinogenic metals, nanomaterials)
  - Waste treatment of batteries: health and fire risk
  - Challenge to determine the precise contents of batteries
OSH and green transport

- **Electrification of the road transport in the next 10 years**
  - Electrocution, fire, explosion during quick charging of E-Vehicles or after accidents
  - Maintenance of E-Vehicles: workers not familiar with high voltages involved (360-500V)

- **Increase in two-wheeled vehicles for the transport of people, goods & services**
  => Job opportunities for “mobility self-entrepreneurs” & micro-E

- **Increased use of fuels with different properties than petrol**
  - LNG late ignition of vapour cloud → scale of hazard: 3km for fire, 5km for vapour dispersion explosion

- **New potentially hazardous materials for lighter, more efficient vehicles**
  - e.g. nanomaterials, carbon fibres
Conclusions: Green economy…

New risks and …

… not-so-new risks, but in new guise

• may affect new players with different risk perception
• may not be thought of in the new situation, or combinations in which it will be found
Conclusions

- **Challenges:**
  - A diversity of workplaces with specific situations
  - New OSH skill sets needed
    - New entrants possibly unskilled to perform in a healthy and safe manner
  - Polarisation of the workforce: highly skilled vs. manual & difficult jobs
  - Maintenance: a challenge common to all green technologies addressed
  - OSH overlooked: time pressures - innovation rate, subsidies/their withdrawals
  - New materials with (unknown) health effects along the life-cycle
    - Diseases are difficult to trace back to jobs as no-one stays in the same job for life
  - Zero waste economy: dealing with the most difficult tail end of the waste stream

- **Towards a sustainable green economy:**
  - Mainstream OSH into other disciplines at policy, R&D, and operational levels
  - “Prevention through design” → more efficient and cheaper than retrofitting
  - Robust awareness-raising measures and training for employers and workers
  - Workplace risk assessment: a powerful tool to deal with old and new risks
  - Consider the specificity of the working situation, working process, and workforce!
Conclusions: The scenarios

- **A useful tool to:**
  - To anticipate possible new and emerging risks
  - To mainstream OSH into other disciplines
  - To encourage people to think outside their “usual box” in a neutral context (the future) removed from the constraints of the present in order to generate new insights
  - And to test policies against different assumptions to develop future-proofed, surprise-resistant policies
Promotion

- **Publications:**
  - Foresight report
  - Summary report + PPT cartoons
  - Also in DE, ES, FR, IT, PL
  - E-facts
  - Green construction
  - Small-scale solar energy
  - Report+ E-fact on Wind energy

- **Workshops:**
  - With the Focal Points: 12-13 Nov. 2013
  - With sectoral social dialogue committees

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**Visit our Website!**

- Workers’ safety and health in green jobs
  The EU is working hard to balance economic growth with the need to protect the environment, and has set itself challenging targets for reducing greenhouse gas emissions, increasing energy efficiency and promoting renewable energy, and reducing waste. This has given rise to a wide range of green jobs – jobs which contribute to preserving the environment, or restoring it to what it was. If they are to be truly sustainable, though, we need to make sure that these jobs provide safe, healthy and decent working conditions. Green jobs need to be good for workers, as well.

**What are green jobs?**

Green jobs cover a wide range of different jobs in different sectors, and involves a diverse workforce. There are many different definitions of the term, such as the ones by the United Nations Environment Programme, the European Commission or Eurostat. But green jobs can be understood as contributing, in some way, to the preservation or restoration of the environment. They can help to achieve energy efficiency. Meeting these objectives will result in rapid growth in the ‘green economy’ – for example, the targets to increase renewable energy and energy efficiency by 20% compared to 1990 levels, is expected to lead to over 1 million new jobs in the EU. Solar power, wind energy, biomass technology and waste recycling are the areas of the green economy that are experiencing the most rapid growth.

**Why is it Important to consider OSH in green jobs?**

We tend to associate the word ‘green’ with safety – but what is good for the environment is not necessarily good for the health and safety of workers who are engaged in green jobs. In some cases, however, we have seen new legislation and technologies, designed to protect the environment, resulting in workers being put at greater risk. Reducing the amount of waste being sent to landfill, for example, has resulted in higher rates of accidents and illnesses among workers whose job it is to process it.

The new technologies or working processes associated with green jobs can lead to new hazards, which call for new combinations of skills to deal with them: the ‘old’ OSH knowledge cannot simply be transferred to them. Installing a solar water heater, for example, involves combining the skills of a roofer, a plumber and an electrician.

The speed at which the green economy is expected to expand could lead to skills gaps, with inexperienced workers involved in processes that they have not been trained for, and who therefore put their safety and health at risk. There may also be a stronger polarization of the workforce towards skills, with low skilled workers pushed to accept poorer working conditions. Last but not least, economic and political pressure could lead to OSH concerns being overlooked.

If green jobs are to be truly sustainable we need to make sure that they are to the benefit of workers’ safety and health, as well as of the environment. In the green economy, as elsewhere, good OSH plays a vital role in increasing competitiveness and productivity. In this fast-developing area, we need to ensure that what is good for the environment is good for workers too.

**What is EU-OSHA doing to prevent new and emerging OSH risks in green jobs?**

Given how quickly the green economy is expected to grow, it is important that we anticipate any new or emerging OSH risks in relation to green jobs before they appear. That is why EU-OSHA has carried out a detailed foresight study, looking at how work in green jobs is likely to develop by 2020, and what future OSH challenges this may bring. The study has identified a number of possible future scenarios, given developments in green technologies, under different economic and social conditions. The aim is to draw attention to potential OSH risks in this area, and assist EU policymakers, in particular, with tools to help them shape the workplaces of tomorrow, and keep Europe’s workers safe and healthy.

**Know more on:**

- The foresight report on OSH in green jobs
- The summary of the report and the scenarios
- The cartoons featuring the new and emerging OSH risks in the scenarios
Thank you for your attention!

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