CLIMATE-DRIVEN TRENDS INFLUENCING FUTURE OCCUPATIONAL SAFETY AND HEALTH

Background and context

This policy brief[1] is one of a series that focuses on OSH challenges and opportunities related to climate change and crises. Through the development, exploration and analysis of future scenarios, this study aimed to explore the **potential indirect impacts of climate change on OSH and the nature of work in Europe over the next 10 to 25 years.**

This policy brief, the first of three, outlines **key factors and trends influenced by climate change which in turn impact OSH and the world of work**. The other two briefs in this series focus on key threats and opportunities going forward, as well as future scenarios. The insights described in this policy brief are primarily based on an evidence review and expert inputs gathered through an online survey and a stakeholder workshop. Experts included stakeholders from academia, research institutions, trade unions, employers' organisations and industry, offering a diverse range of expertise in climate, OSH and foresight research methodologies. More information is available in the project's final report.

Examples of indirect effects of climate change

Climate change could make some regions uninhabitable, leading to large-scale migration. This could change the composition of the workforce and increase the prevalence of informal work, while also creating challenges such as language barriers that make safety communication more difficult.

Climate change is prompting adaptation and mitigation measures that affect the world of work and OSH. Modifications to infrastructure and urban planning in response to flooding or heatwaves, for instance, can alter workplace environments and processes, with significant implications for OSH. Similarly, the adoption of AI and digital technologies to enhance climate resilience could create new roles and skill requirements, potentially introducing novel OSH challenges.

Future climate-driven key factors and trends influencing OSH

Key factors and trends that are shaping OSH in response to climate change[2] each influence OSH in distinct ways, but they also interact, often amplifying risks or generating new challenges for workers. Understanding their effects and how they interplay is essential for anticipating emerging OSH issues and designing effective, inclusive policies to protect workers in a rapidly changing environment.

[1] The European Agency for Safety and Health at Work (EU-OSHA), based in Bilbao, Spain, plays a pivotal role in making working life across the European Union (EU) safer, healthier and more productive. One key aspect of its work is anticipating future changes in the world of work by undertaking foresight studies that inform policymakers, researchers and workplace stakeholders about emerging OSH risks and help set research and action priorities. Previous foresight cycles have explored OSH risks associated with the circular economy (European Agency for Safety and Health at Work, 2021), digitalisation (European Agency for Safety and Health at Work, 2018) and green jobs economy (European Agency for Safety and Health at Work, 2013), and generating macro and micro scenarios to guide targeted interventions. The reports on the fourth foresight cycle are delivered by RAND Europe in partnership with the Insight Foresight Institute (IFI) and the support of the Austrian Institute of Technology (AIT) as part of the Foresight-on-Demand consortium.

[2] Identifying key factors and drivers of change is a crucial step in the foresight and scenario planning methodology. In the context of this study, these factors are intermediaries in the pathway linking climate change to OSH and other workplace outcomes. Identifying these factors was an important step in the project's methodological approach, enabling the creation of future scenarios (presented in the second policy brief for this project) that illustrated how the factors might develop, interconnect and influence OSH and the world of work.

Adaptation and mitigation strategies

Building on the strong scientific consensus of the Intergovernmental Panel on Climate Change (IPCC) on the worsening climate crisis, Europe has been developing and implementing a range of **adaptation and mitigation strategies to address climate change**. The European Union (EU) has reinforced its climate agenda by adopting a target to reduce net greenhouse gas emissions by 90% by 2040 compared to 1990 levels (ESG News, 2025). This builds on the interim goal of a 55% reduction by 2030, a goal set under the 'Fit for 55' package (Council of the EU, 2025). To accelerate industrial decarbonisation, the Clean Industrial Deal launched in 2021 allocates approximately EUR 100 billion to clean technologies, renewable energy deployment, streamlined regulation, and the establishment of a decarbonisation bank, while also aiming to reduce energy costs for industry (European Commission, 2025). The EU Adaptation Strategy, adopted in 2021, promotes smarter, faster, and systemic adaptation through data, tools, and nature-based solutions (European Commission, 2021). Additionally, the EU Mission on Adaptation to Climate Change mobilises hundreds of regional and local authorities to design and implement resilience and risk-management measures tailored to local contexts (European Environment Agency, 2026).

Mitigation involves actions aimed at reducing or preventing the emission of greenhouse gases to limit the magnitude and rate of climate change, including transitioning to renewable energy, increasing energy efficiency, and implementing carbon capture technologies.

Adaptation, on the other hand, refers to measures that help societies, economies and environments adjust to the current and anticipated impacts of climate change, such as improving infrastructure resilience, developing climate-resilient crops, and enhancing disaster preparedness.

Adaptation and mitigation strategies, while essential for addressing climate change, have important implications for OSH. Mitigation strategies such as transitioning to clean technologies and renewable energy can introduce new workplace risks, such as exposure to novel materials, changes in work processes, and the need for specialised skills and training. Adaptation strategies such as resilience measures may alter the tasks involved in a job or increase outdoor work, potentially heightening exposure to extreme weather or biological hazards. Furthermore, the pace and scale of regulatory change may challenge smaller businesses and vulnerable workers, increasing the risk of non-compliance or inadequate protection.

Automation and technology use

Digitalisation and artificial intelligence (AI) are increasingly recognised as pivotal tools for addressing climate change challenges (World Economic Forum, 2021; OECD, 2025), while also contributing to improving OSH outcomes (Lloyd's Register Foundation, 2025). For example, AI can optimise energy use in buildings, monitor environmental conditions, and enhance early warning systems for extreme weather events (Ogundiran, Asadi and Gameiro da Silva, 2024; United Nation University, 2024), while digital technologies can automate hazardous tasks and improve workplace safety monitoring (Human Resources Online, 2025).

The adoption of AI and digital technologies to enhance climate resilience could create new job roles and skill requirements, potentially introducing novel OSH challenges. Rapid innovation and rushed deployment of new technologies may also bring unintended consequences (Ertelt and Carlborg, 2024). When technological development outpaces regulation, it can result in a fragmented landscape of costly and unreliable systems. However, if Europe chooses not to adopt new AI technologies, it might risk losing its competitiveness, potentially leading to economic decline and making a 'just transition' unattainable. In some cases, these technologies may introduce new risks or even cause harm to workers, particularly if safety considerations are overlooked during implementation. A previous EU-OSHA foresight study explored the new and emerging OSH risks associated with digitalisation, highlighting concerns such as cyber threats, psychological strains from increased screen time, and various safety and health issues arising from human-machine interfaces (European Agency for Safety and Health at Work, 2018). EU-OSHA has recently been working to raise awareness of these issues through its Safe and Healthy Work in the Digital Age campaign[3].

[3] See https://healthy-workplaces.osha.europa.eu/en.

Circular economy

The EU has been actively promoting the circular economy since 2015 (European Commission, 2019). With 45% of global greenhouse gas emissions linked to manufacturing and land management, the circular economy aims to mitigate climate change by extending product lifespans and minimising waste, in contrast to the traditional 'take-make-dispose' model (Ellen MacArthur Foundation, 2025). This approach could reduce emissions from heavy industry in the EU by 296 million tonnes of CO_2 per year (a 56% reduction) by 2050 (Material Economics, 2018), while also providing societal benefits such as job creation and improved quality of life through a cleaner environment. Employment in circular economy sectors had risen to over 4 million in Europe by 2021 (European Environment Agency, 2025b), and a more circular economy could create 700 000 new jobs by 2030, particularly in repair and recycling (Cambridge Econometrics, Trinomics, and ICF, 2018). The shift towards a circular economy creates both opportunities and challenges for OSH, as highlighted in a previous EU-OSHA foresight study (European Agency for Safety and Health at Work, 2021). For example, the integration of automation and digitalisation into the circular economy can significantly improve the waste and recycling process and reduce workers' exposure to hazards; on the other hand, new technologies and new materials can introduce new risks related to new materials and design processes, for example. Workers will need new skills and training in materials science, environmental management and green technology for these circular economy jobs (CEDEFOP, 2023).

Economic instability

Climate change has already affected the economy in multiple ways, including its impacts on resource allocation, investment patterns and international trade. According to the IPCC, climate change has led to an increased frequency and intensity of extreme weather events, including heatwaves. Between 2021 and 2024, extreme weather and climate events caused over EUR 208 billion in economic losses in the EU. Additionally, all four of these years ranked among the top five years with the highest annual economic losses since 1980 (adjusted for inflation to 2024 euro prices), suggesting that losses from extreme weather events are increasing over time (European Environment Agency, 2025a). These events disrupt supply chains, damage infrastructure and undermine business continuity. Beyond immediate financial losses, climate change is linked to broader negative trends such as reduced economic output, lower productivity and shortened lifespans (Kalkuhl and Wenz, 2020; Roy, 2024). In 2023 alone, heatwaves resulted in the loss of 490 billion productive work hours globally (Romanello et al., 2023), highlighting the scale of disruption to the global workforce.

Such economic instability can have important implications for OSH. When organisations face financial strain, investment in workplace safety and injury prevention may be deprioritised, increasing risks for workers (Caskey and Ozel, 2017). Additionally, ongoing disruptions can threaten job security, leading to higher rates of precarious employment and reducing the resources available for maintaining safe working conditions (Anyfantis, Boustras and Karageorgiou, 2018). Economic instability may also reduce the employment options available to workers, forcing them to accept unsafe or insecure work in the absence of less hazardous alternatives (Anyfantis, Boustras and Karageorgiou, 2018). As well, creative innovations to reduce costs could possibly also result in solutions which supports better OSH.

Climate-driven migration

Climate change is expected to make some regions uninhabitable, driving both internal and international migration. Estimates suggest there could be up to 200 million environmental migrants by 2050 (Skeldon, 2025). On the one hand, migration brings new skills and diversity to the workforce (ILO, 2025), but it can also expose the vulnerabilities of individuals who arrive in search of refuge and opportunity (David, Bryant and Larsen, 2019).

Migrants, especially those moving from lower- to higher-income countries, are often at greater risk of poor living conditions and increased workplace accidents due to inadequate access to health and safety protections (Anyfantis, Boustras and Karageorgiou, 2018). Undocumented migrants also face an increased risk of exploitation and work in unregulated, unsafe environments. Language and cultural barriers can further complicate their ability to understand safety instructions, increasing OSH risks (Moyce and Schenker, 2018).

New materials

Adaptation and mitigation strategies can affect OSH through the introduction of new materials, including nanomaterials and biological agents. These substances are increasingly used in sectors such as construction, manufacturing and environmental management to improve efficiency, reduce emissions, and enhance resilience to climate change (Ferreira et al., 2023; AZO Build, 2024). However, their novel properties may present unknown or poorly understood risks to workers. For example, nanomaterials can have unique physical and chemical characteristics that make them useful in innovative products and processes (Firoozi, Firoozi and Maghami, 2025), but these same properties can pose challenges for risk assessment and management. Workers may be exposed to nanoparticles through inhalation, skin contact or accidental ingestion, and the long-term health effects are not yet fully understood (OSHA, 2007). Following the principles of Hierarchy of OSH Controls (or Hierarchy of Prevention)[4], eliminating these emerging hazards entirely, or at least substituting them with less harmful materials, is important. Reliance on lower-tier controls, such as engineering controls (e.g. adequate personal protective equipment [PPE]) or administrative controls (e.g. training), could only be effective if higher-level interventions are not possible.

New materials may also, however, offer significant benefits for workers. For example, advances in materials science can lead to improved PPE that is lighter, more comfortable and more effective at protecting against hazards. In addition, innovative materials can contribute to safer work environments by enabling the development of building components with enhanced fire resistance or improved insulation, reducing risks associated with extreme temperatures or fire exposure in the workplace.

Social and wealth disparities

Existing evidence shows that climate change disproportionately affects poorer populations, people living in rural areas, women and other marginalised groups due to their limited access to resources and pre-existing social and economic disparities (Eastin, 2018; Paglialunga, Coveri and Zanfei, 2022). Research also indicates that climate change and certain climate policies can widen income inequality (Cevik and Jalles, 2023; Bettarelli et al., 2024). For instance, policies designed to reduce carbon emissions may result in higher energy prices, which disproportionately impact low-income households that spend a greater share of their income on energy.

Climate change-related job losses and disruptions also tend to affect workers in vulnerable sectors such as agriculture, fisheries and tourism. These industries employ a large proportion of low-income workers, compounding the economic challenges faced by these populations. While strong OSH protections can improve conditions for many workers, those outside formal employment – such as informal or undocumented workers – may still face hazardous working environments and lack access to basic protections (OECD, 2023).

Key takeaways

- **There is strong scientific consensus that climate change and its environmental impact are intensifying and increasingly affecting OSH**. Because policymakers must navigate significant uncertainty about the specific impacts of climate change on OSH, it is challenging to anticipate and address emerging risks effectively. While climate adaptation and mitigation strategies are crucial for building resilience, they may introduce unforeseen consequences that could negatively affect worker safety. When addressing these emerging challenges, it is essential for cross-sectoral stakeholders to adopt a holistic approach grounded in coordinated and proactive planning. This means anticipating complex interactions, remaining agile amid rapid societal and technological changes, and integrating OSH considerations into climate-related policies and initiatives.
- **Inclusive and equitable strategies should also be prioritised – particularly those that protect vulnerable populations such as migrant workers and individuals in precarious employment.** The EU's Just Transition Mechanism[5], for example, is designed to ensure that the transition to a climate-neutral economy is fair and inclusive, especially for regions, industries and workers most affected by the shift away from fossil fuels. This offers a promising framework

[4] See https://www.osha.gov/sites/default/files/Hierarchy_of_Controls_02.01.23_form_508_2.pdf.
[5] See https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism_en.

to maximise the benefits of climate actions while minimising negative impacts on workers (European Commission, 2020). Achieving the goals of a just transition will require coordinated efforts among government agencies, employers, workers, trade unions and OSH professionals.

- By acknowledging the **multifaceted indirect implications** of climate change on OSH, stakeholders can work together to create safer, more resilient workplace environments that not only protect workers but also promote their overall health and security in increasingly unpredictable conditions.

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