

Key findings

- 13% of workers in European OECD countries and the United States report suffering from significant heat-related discomfort (i.e. are exposed to high temperature which make them perspire even when not working) at least half of their working time, with peaks of 26% in Türkiye, 25% in Spain, and 22% in Greece.
- Workers in outdoor occupations and workers in process and heavy industries are particularly affected by heat: 55% of street workers in the United States and Europe as well as 55% of farmers in the United States and 53% in Europe and 46% of food preparation assistants in the United States and 43% in Europe report suffering from significant heat-related discomfort.
- The characteristics of the workers experiencing significant heat-related discomfort (typically mid- low-skilled men in rural areas) are similar to those of workers currently employed in emission-intensive occupations. This suggests that while the policies to reach climate neutrality may be costly for some groups of workers, there are also costs to inaction for these same groups.
- Regions where the share of workers experiencing heat-related discomfort is already very high (e.g. several regions in Greece and Spain) are also those where heat stress is predicted to increase more by 2050. However, as heatwaves increasingly occur in places where they were not previously a major threat, even regions where the share of workers is currently low will have to take measures to adapt the working environment and protect workers.
- Existing occupational safety and health (OSH) regulations already cover aspects related to temperature and heat stress at work. However, several OECD countries, often with the direct involvement of the social partners, are developing specific strategies and introducing new regulations or tools to help workers and enterprises cope with the consequences of rising temperatures and reduce the risks for workers and companies.

The costs of a warming workplace

Despite concerted efforts to curb global greenhouse gas emissions, the impacts of climate change are intensifying and economic damages from climate-related weather events are rising and expected to rise even further. Beyond extreme weather events that grab the news headlines, rising temperatures will have less visible but sizeable effects on human health, workers' and firms' productivity and opportunities for upward mobility, ultimately affecting economic growth (Park, 2024^[1]).

Gradually increasing global temperatures also mean an increase in the intensity and duration of heatwaves. In addition, heatwaves are increasingly occurring in places where they were not previously a major threat. Looking further into the future, heatwaves are projected to become more frequent, persistent and intense in almost all inhabited regions.

Increasing temperature and more frequent heatwaves will have a direct impact on the labour market (ILO, 2024^[2]). Heat exposure is a well-recognised and documented occupational health and safety risk. Heat-

stress – which depends on many factors such as ambient temperature, sun exposure or other heat sources, relative humidity and air movement, as well as the clothing worn, work demands and metabolic heat – can cause fatigue, reduced alertness and concentration, poorer information processing quality, increased reaction times, blurred vision, irritability and mood changes. Heat therefore interferes with the performance of physical tasks as well as complex and cognitively demanding activities or relatively simple and routine tasks that require special attention (such as monitoring and control). As a result, heat stress has been shown to lower productivity, increase absenteeism, heighten the risk of work-related accidents, including fatal ones as well as compromising the functioning of machinery and infrastructure (Park, 2024^[1]). Romanello et al. (2023^[3]) estimated that high temperatures led to 490 billion lost labour hours in 2022 around the world, a nearly 42% increase from 1991 to 2000. Heat can also complicate the implementation of health and safety measures, such as the use of personal protective equipment, which may itself become a hazard in high temperatures.

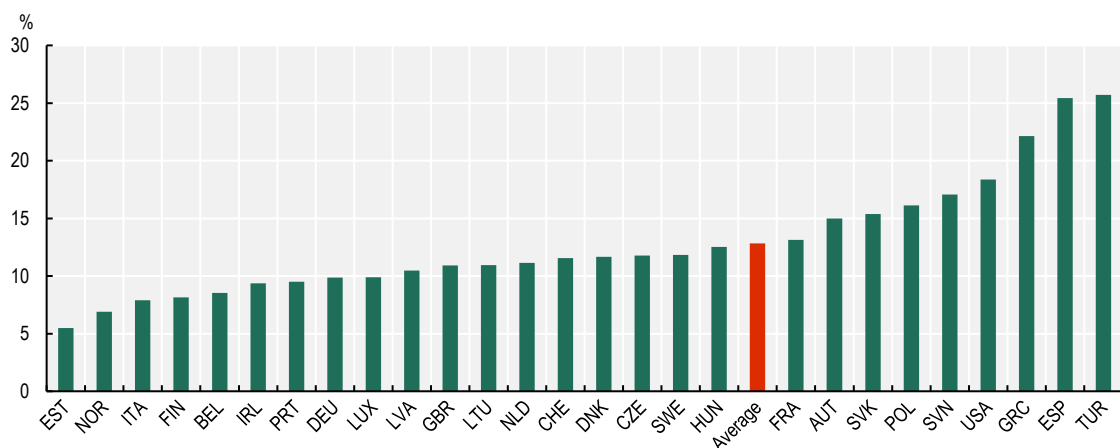
Many workers will experience the effects of rising temperatures and more frequent and intense heat waves. However, the extent of their exposure and vulnerability, and therefore the cost that they will pay, will vary according to their occupational situation and geographical location and their ability to adapt. This policy brief provides an overview of the workers exposed to rising temperatures in OECD European countries and the United States, and reviews some of the measures that countries and social partners are taking to protect workers' health and safety, as well as initiatives to adapt workplaces and work organisation.

13% of workers report heat-related discomfort in Europe and the United States

In European OECD countries and the United States, according to the latest data available, 13% of workers declare experiencing significant heat discomfort (i.e. being exposed to high temperature which make them perspire even when not working at least half of their working time), with peaks of 26% in Türkiye, 25% in Spain, and 22% in Greece. On average, an additional 10% of workers were exposed to high temperatures at least one-quarter of their working time.

Figure 1. One in seven workers reports heat-related discomfort in Europe and the United States

Percentage of employees who declare to experience heat-related discomfort at least half of the working time, 2015



Note: Those who declare to be exposed to high temperature which make them perspire even when not working at least half of their working time are classified as experiencing heat discomfort. The shares are the predictions in May, obtained by running a regression of the exposure to heat at country level on the share of respondents by month of interview. The average is unweighted.

Source: Secretariat's calculations based on data from European Working Conditions Survey (Eurofound) and American Working Conditions Survey (RAND Corporation).

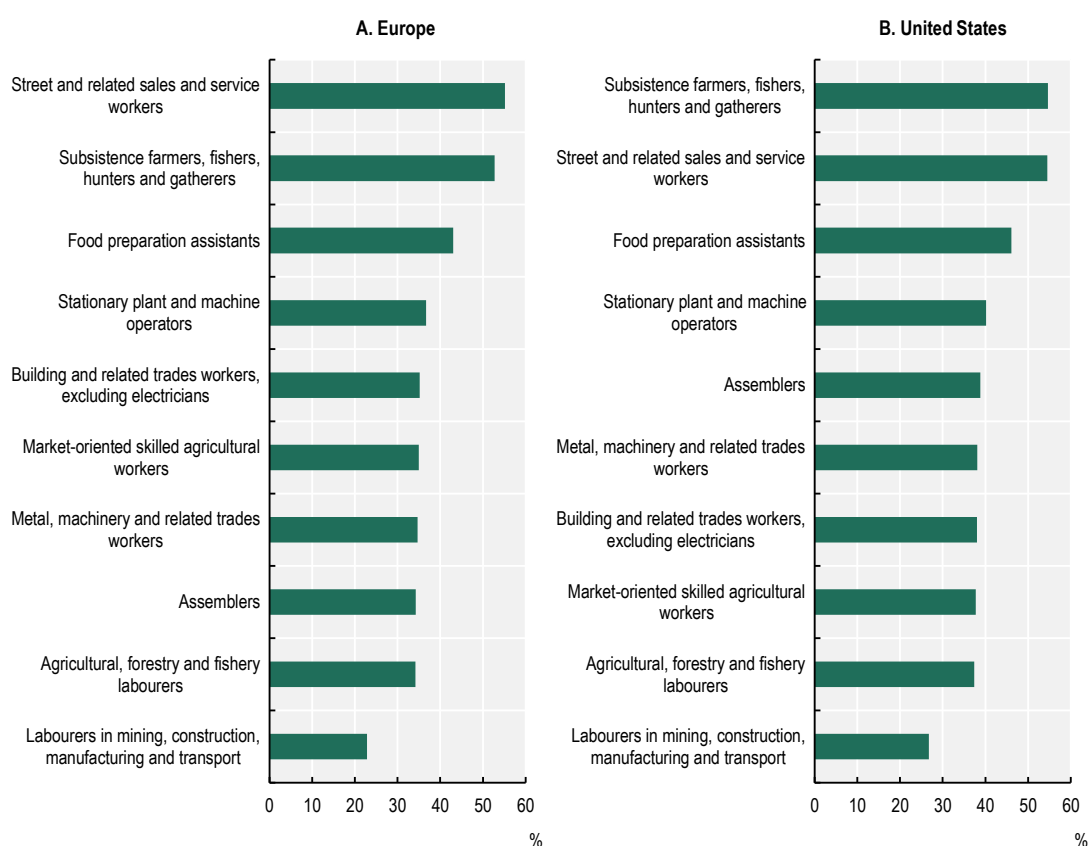
National averages hide considerable variation within countries. Even in countries where the national average is below the OECD one, some regions stand out. For example, the share of workers declaring experiencing significant heat discomfort reaches 17% in North Jutland in Denmark, 19% in Eastern Switzerland or 24% in the Moravian-Silesian region in Czechia.

Some occupations are particularly exposed

Sectoral and occupational characteristics contribute to explain much of the variation across countries: as it can be seen in Figure 2. Both in European OECD countries and in the United States, workers in outdoor occupations (e.g. street vendors, construction workers, farmers and fishers) are particularly affected by heat (as well as cold), as are workers in process and heavy industries. At the other end of the spectrum, the occupations which declare to be least exposed to heat discomfort are office workers who are also those most likely to benefit from ongoing and future investments in climate change adaptation measures such as the insulation of buildings and air conditioning.

Figure 2. Workers in outdoor, process and heavy industries report higher than average heat-related discomfort

Percentage of employees who declare to experience heat-related discomfort at least half of the working time, 2015



Note and source: See Figure 1. Europe includes Austria, Belgium, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland and the United Kingdom. For some occupations, there are missing countries: Street and related sales and service workers (Belgium, Ireland, Lithuania, Portugal and the Slovak Republic); Food preparation assistants (Austria); Assemblers (Greece and Luxembourg).

The occupations most exposed to heat discomfort are predominantly mid- and low-skilled. Going forward, with increasing temperatures due to climate change, these occupations, which are already experiencing higher heat discomfort, could become even more difficult to perform.

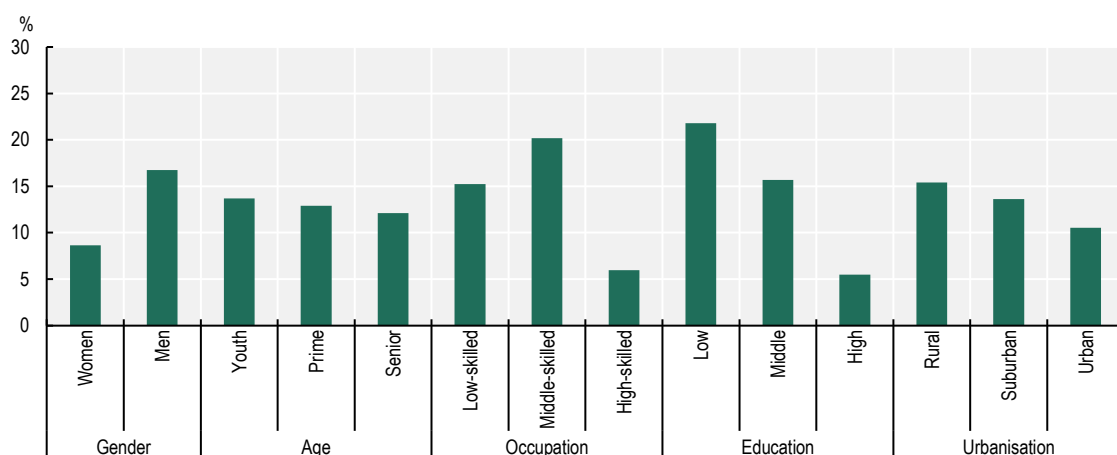
Moreover, as already highlighted by Benhamou and Flamand (2023^[4]), certain professions such as emergency services or healthcare workers will be exposed to a double burden: they will be exposed to increasing temperatures, as they do a physical-intense work mostly outside and/or wear personal protective equipment which can unintentionally contribute to heat stress, and will also be called to respond to more frequent extreme weather events and fires and face a higher influx of patients during heatwaves, leading to higher workload and stressful and physically demanding conditions.

The burden of a warming workplace will fall on workers with similar characteristics to those who are also more exposed to the transition risks associated to carbon neutrality

The highest proportions of workers exposed to heat discomfort are to be found in rural areas and, as already mentioned, are more likely to be low- and medium-skilled workers (i.e. sales workers, skilled agricultural workers, craft workers and plant workers, Figure 3). Also because of their occupational concentration, men declare to experience more heat discomfort than women, while older workers tend to experience less heat discomfort than younger ones. These findings are in line with evidence from the United States where racial minorities, non-US citizens, and individuals without access to health insurance face systematically higher levels of exposure to extreme temperature on the job (Park, 2024^[1]).

Interestingly, the characteristics of workers more exposed to global warming identified in Figure 3 largely mirror those of workers in greenhouse gas (GHG)-intensive occupations, who, according to the *OECD Employment Outlook 2024* (OECD, 2024^[5]), also tend to be male, mid-skilled and located in rural areas. The similarity in the characteristics of workers most at risk of job loss due to the policies to reduce emissions and those most exposed to the physical and health risks of rising temperatures suggests that the social and labour market costs of tackling climate change should be compared with the costs of inaction, and that the apparent trade-offs between fighting against climate change and livelihoods in certain occupations and regions may not be a trade-off at all.

Figure 3. Heat-related discomfort affects young, low educated, rural men working in middle-skilled sectors more than anyone else

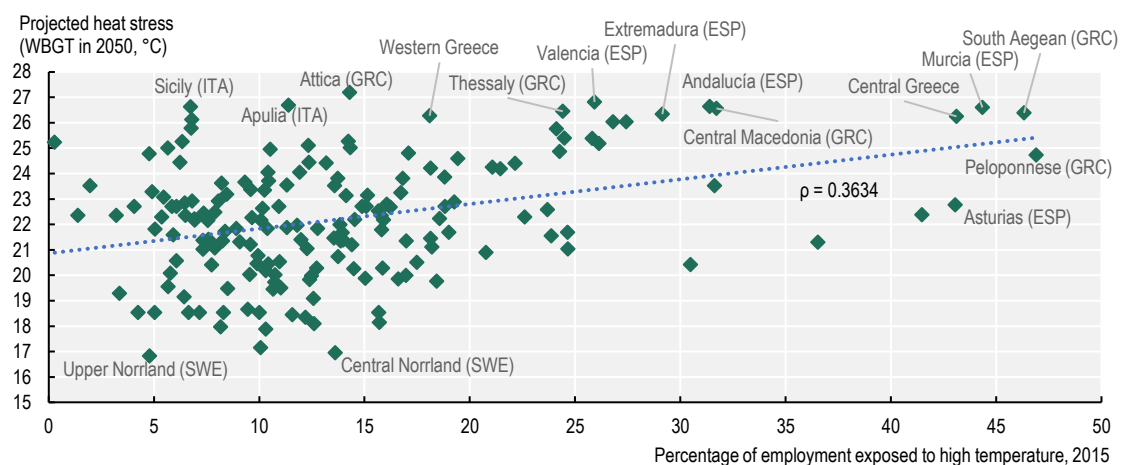


Note and Source: See Figure 1: Youth are those aged from 15 to 24, prime from 25 to 54, and senior from 55 and above. For urbanisation, the United States is not included.

Regions with higher proportions of workers reporting heat-related discomfort are also projected to face higher heat stress in 2050

Looking into the future, regions where workers already report heat-related discomfort, typically many southern regions of Europe, are also those that are predicted to experience higher heat stress in the coming decades, if no further mitigation or adaptation actions are taken, as per the projections by Casanueva et al. (2020^[6]) and García-León et al. (2021^[7]). This means that, while the characteristics and the distribution of jobs across countries and regions will evolve and investments in adaptation will improve the working conditions of many workers, looking at the *current* exposure to heat discomfort is likely to be a good proxy of *future* exposure. Yet, in countries and regions where heatwaves are a more recent phenomenon, the effects of heat stress may be more challenging as buildings and work organisation may be less prepared.

Figure 4. European regions with higher proportions of workers reporting heat-related discomfort are also projected to face higher heat stress in 2050



Note: Projected heat stress in 2050 is measured using the Wet-bulb Globe Temperature (WBGT) and assuming that no further mitigation or adaptation actions are taken. The TL2 regions for which the number of observations is fewer than the bottom 10th percentile (i.e. 30 observations) are removed. For France, the 2010 data are used.

Source: Secretariat's calculations based on data from the European Working Conditions Survey (Eurofound) and Casanueva et al. (2020^[6]) and García-León et al. (2021^[7]).

What role for policies?

While the implementation of the ambitious climate targets that OECD countries have agreed to will eventually slow down and hopefully stop temperature increases, some temperature rises are unavoidable. Therefore, OECD member states are setting in place a number of policies to reduce the occupational risks. This section builds on the OECD policy questionnaire on labour and social policies for the net-zero transition that was distributed at the end of 2023 to briefly describe what OECD countries as well as trade unions and employers' organisations are doing to adapt the labour market to the consequences of increasing temperatures and more frequent and intense heatwaves. The different policies range from risk assessments, policy workshops engaging stakeholders and promoting social dialogue to specific OSH policies and labour tools that support workers during heatwaves.

Some OECD countries are developing specific strategies to respond to rising temperatures

Occupational safety and health (OSH) regulations in OECD countries already cover aspects related to temperature and heat stress at work. In the European Union, for instance, the principles of the 1989 framework directive on health and safety at work as well as some related other EU directives can be applied to heat stress. However, as reported in the OECD policy questionnaire on labour and social policies for the net-zero transition that was issued in late 2023, some OECD countries are developing specific strategies to better reflect the scale of the new challenge.

In Greece, for example, between 2017 and 2023, the Ministry of Labour and Social Affairs, in collaboration with the key stakeholders, developed an integrated framework to protect workers to better anticipate, measure and put in place preventive and reactive measures to heat stress.

Spain has developed a Health and Safety Strategy 2023-27 (*Estrategia Española de Seguridad y Salud en el Trabajo, 2023-27*) with the specific aim of addressing the occupational health and safety challenges of the coming years. Among the lines of action identified related to heat, there are specific ones to raise awareness and support companies in activities most exposed to extreme temperatures, especially where there are vulnerable, more exposed, or sensitive groups of workers. The strategy also aims to improve the reporting of accidents related to high temperatures, as they are currently mostly reported as having a different cause (typically cardiovascular).

France has taken a similar approach. Its fourth occupational health plan (*Plan de santé au travail*) published in 2023 explicitly recognises more frequent heatwaves as one of the main risks to occupational health and safety. Better monitoring of mortality and morbidity of workers associated with heatwaves is therefore recommended. Moreover, work is underway to define objective, measurable criteria for considering activity restriction measures for workers during heat waves. Finally, measures are being taken to raise awareness among companies of the risks associated with heat waves.

Germany is conducting a series of policy workshops on “Climate Change Work” (*Arbeit: Sicher+Gesund*) to assess the impact of climate change on occupational safety. The aim of this multi-stakeholder process, which will be concluded in 2025, is to develop political and operational solutions for adapting working conditions to climate change.

Health and safety are core concerns for the social partners

In several countries, the social partners are directly involved in the development of adaptation strategies and, more generally, in efforts to meet the ambitious challenges that climate change adaptation policies require. For example, the Spanish Health and Safety Strategy 2023-27 was developed in consultation with the social partners. The French occupational health plan is based on a collective agreement between peak-level employers’ organisations and trade unions signed in 2020. In Germany and Greece, social partners are among the stakeholders involved in the process.

More generally, health and safety issues are very much at the forefront of trade union campaigns and activities. In France, for example, the trade union *Confédération Générale du Travail* (CGT) is calling for the introduction of a temperature threshold above which no activity is possible. At the European Union level, the tripartite Advisory Committee on Safety and Health at Work is working on an opinion on heat stress, that will include recommendations to protect and maintain workers’ health and safety.

Social dialogue and collective agreements at company and sector level are also used to regulate work organisation. In Spain, for example, an autonomous foundation linked to the *Comisiones Obreras* (CCOO) has developed a set of technical guidelines to help workers’ representatives, together with employers, develop company action plans to deal with heat waves and extreme heat events.

Finally, the social partners are helping to raise awareness: during the summer, many trade unions and employers' organisations provide their members with practical guidance on the precautions to be taken.

New regulations and tools are being developed to support workers and businesses

Some countries, again often with the direct involvement of the social partners, have adapted the existing OSH regulations to the specific challenges posed by climate change or developed specific OSH programmes and tools. For instance:

- In Belgium, since 2019, when the wet globe thermometer (WBGT) which considers not just the air temperature, but also humidity and the radiation temperature of objects in the environment exceeds certain thresholds that vary by occupation, the employer must take measures to protect workers. In addition, Belgium has also introduced measures to address high levels of ozone, which can cause symptoms such as breathing difficulties and eye irritation in hot weather.
- In Canada, the National Adaptation Strategy of 2022 includes workplace adaptation measures such as adjusting working hours and conditions to avoid peak heat periods, providing shade, rest breaks and hydration for outdoor workers, and implementing heat health training programmes to recognise and respond to heat-related illnesses.
- Lithuania has added specific provisions to the Labour Code in 2017 to provide for special breaks of at least 40 minutes during an 8-hour working day for workers who work outdoors with temperatures below -10°C or above +28°C, or in unheated spaces with temperatures below +4°C.
- In Spain, the 2023 law stipulates that during an orange or red alert, it is mandatory to adapt working conditions by reducing or modifying working hours, provide shaded areas for outdoor workers and ensure access to cool drinking water.

More generally, practical guidance on managing heat-related risks has been developed by occupational safety and health agencies in several countries (Safe Work Australia, CCOSH in Canada, OSHA in the EU as well as national agencies, HSE in the United Kingdom and NIOSH in the United States). Specific initiatives have also been taken in some of the most exposed sectors (e.g. agriculture in Lithuania or construction in Austria, Germany and Lithuania), including the development of new tools (e.g. a warning system accessible to employers and workers with site-specific forecasts in Slovenia). In addition, in a few OECD countries (e.g. Belgium, France, Italy, Spain), companies can, under certain conditions, use the job retention scheme in the event of exceptionally high temperatures.

Finally, in addition to implementing and adapting occupational health and safety regulations, improving the energy efficiency of buildings has also a potential to reduce temperatures for workers who work indoor. Measures to promote the renovation of buildings are quite common in OECD countries. Some are specifically targeted to companies. In Canada, for instance, the National Adaptation Strategy foresees the enhancement of urban tree canopy to provide relief during heatwaves, the improvement of buildings and infrastructure design to ensure better adaptation to extreme weather. In Czechia, the New Green Savings Programme provides subsidies to renovate or build buildings to reduce energy intensity and adapt to climate change. In Germany the "Building Energy Act" foresees specific measures to ensure that new buildings are constructed in a way to minimise the absorption of solar radiation.

Concluding remarks

This policy brief shows that, as discussed in the *OECD Employment Outlook 2024* (OECD, 2024^[5]), while climate change mitigation policies may impose costs on OECD labour markets, climate change itself will also affect workers and companies, and inaction is expected to lead to high labour market costs. The costs of inaction will fall more heavily on companies and workers in outdoor occupations and in process and

heavy industries, with potential negative impacts on workers' health and productivity, and affect the regions where the proportion of workers exposed to high temperatures is already higher than average.

These risks are high on the policy agenda of OECD countries and social partners. Several OECD countries, often with the direct involvement of trade unions and employers' organisations, are developing specific strategies and introducing new regulations or tools to help workers and enterprises cope with the consequences of rising temperatures and reduce the risks of occupational hazards.

However, rising temperatures and more frequent heat waves are just one of the risks associated with climate change. Extreme weather events can lead to more frequent wildfires, storms, droughts, floods, and landslides, which can have a significant impact on labour markets in the affected regions, disrupting labour supply due to loss of life, injuries and evacuation of people to areas outside the disaster zone, and labour demand as businesses are forced to close or relocate to other regions. Future work could broaden the perspective adopted in this policy brief to include further risks and examine the broader impact of climate change (and climate inaction) on OECD labour markets.

References

- Benhamou, S. and J. Flamand (2023), *Le travail à l'épreuve du changement climatique*, France Strategie, Paris. [4]
- Casanueva, A. et al. (2020), "Escalating environmental summer heat exposure — a future threat for the European workforce", *Regional Environmental Change*, Vol. 20/40. [6]
- García-León, D. et al. (2021), "Current and projected regional economic impacts of heatwaves in Europe", *Nature Communications*, Vol. 12/1. [7]
- ILO (2024), *Heat at Work: Implications for Safety and Health. A Global Review of the Science, Policy and Practice*, International Labour Office, Geneva. [2]
- OECD (2024), *OECD Employment Outlook 2024*, OECD Publishing, Paris, <https://doi.org/10.1787/ac8b3538-en>. [5]
- Park, R. (2024), *Slow Burn: The Hidden Costs of a Warming World*, Princeton University Press. [1]
- Romanello, M. et al. (2023), "The 2023 report of the Lancet Countdown on health and climate change: the imperative for a health-centred response in a world facing irreversible harms", *The Lancet*, Vol. 402/10419, pp. 2346-2394. [3]

Contact

Stefano SCARPETTA (✉ stefano.scarpetta@oecd.org)

Andrea GARNERO (✉ andrea.garnero@oecd.org)

Satoshi ARAKI (✉ satoshi.araki@oecd.org)

This work is published under the responsibility of the Secretary-General of the OECD. The opinions expressed and arguments employed herein do not necessarily reflect the official views of OECD member countries.

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

The use of this work, whether digital or print, is governed by the Terms and Conditions to be found at www.oecd.org/termsandconditions.