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Perspective

Accelerating Clean Energy Transitions to Safeguard Human Health and Survival

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ABSTRACT: The year 2023 was the warmest year in the 174-year global instrumental record. The year was also marked by a series of climate-related extreme events, including heat waves, storms, and wildfires that caused widespread economic and health impacts. The 28th Conference of the Parties of the United Nations Framework Convention on Climate Change called for transitioning away from fossil fuels and accelerating action in this critical decade. All countries must move rapidly toward net zero emissions and scale up their action to ensure achievement of the Paris climate goals—viz., limiting the global temperature increase from preindustrial levels to well below 2 °C and pursuing efforts to keep it below 1.5 °C. There is growing concern about whether the goal of limiting global warming to 1.5 °C is still achievable. We believe that it is still possible to limit warming to 1.5 °C if we take seven essential actions so human health and survival can be safeguarded: scaling up the energy transition to achieve carbon neutrality before the middle of this century; rapidly phasing out the construction of new fossil fuel exploration and infrastructure; enforcing an international carbon price; tightening emission targets across both the global north and south; promoting and adopting low-consumption lifestyle as the social norm; engaging in transformative change to simultaneously act on climate, biodiversity, equity, human health, and well-being; and boosting collective efforts and strengthening international cooperation.

KEYWORDS: *Clean energy, climate change, climate policy, global warming, human health*

The impacts of anthropogenic greenhouse gases on the Earth's climate are well documented and increases in ambient temperatures have been reported in all parts of the world.[1,2] The global mean near-surface temperature in 2023 was 1.45 °C above the 1850−1900 average, and never has humanity been so close to the 1.5 °C warming limit of the Paris Accord.[2] The year 2023 was the warmest year in the 174-year global instrumental record.[2] Along with changes in average temperatures, there are resultant higher frequencies, longer durations, and wider distributions of extreme temperatures and other extreme weather events, which directly cause a wide range of adverse health outcomes and socioeconomic and ecosystem disruptions.[3] Human health and well-being are also threatened by a serious biodiversity crisis and growing inequalities between and within countries. A healthy and high-quality future is possible only by acting simultaneously on these interdependent crises. To achieve this, one of the key targets is to limit global warming to 1.5 °C.

HEALTH IMPACTS OF CLIMATE CHANGE

Climate change has increasingly affected human health worldwide. Extreme heat and extreme weather events are today the most visible and studied climate hazards.[1,3] These risks have been rapidly aggravating due to climate change. Health impacts of climate change have already occurred on every inhabited continent.[3] For instance, during 1991−2018, 37.0% (range 20.5−76.3%) of warm-season heat-related deaths were attributed to anthropogenic climate change.[4] Heat-related health impacts will increase as temperatures continue to rise. A recent study revealed that during 1990 to 2019, 0.94% (95% CI: 0.68−1.19) of deaths [i.e., 153,078 cases (95% eCI: 109,950−194,227)] per warm season were resulted from heatwaves, accounting for 236 (95% eCI: 170−300) deaths per 10 million residents.[5] Heatwaves were associated with substantial mortality burden over the globe in the past 30 years, and the mortality risk of heatwaves varied with the place and time. The World Meteorological Organization reported that, over the past five decades (from 1970 to 2021), extreme

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weather, climate and water-related events caused 11,778 reported disasters, with over 2 million deaths and US $4.3 trillion in economic losses.[6] Exposure to extreme weather events (e.g., heat, floods, and cyclones) imposes enormous health risks. A study revealed that flooding events lead to increased risks for all-cause, cardiovascular, and respiratory mortality.[7] The flood-mortality associations were stronger in low-income countries and in populations with a low human development index or a high proportion of older people. Across communities impacted by floods, up to 0.10% of all-cause deaths, 0.18% of cardiovascular deaths, and 0.41% of respiratory deaths were attributed to floods at a global scale. Therefore, there is an urgent need for more ambitious mitigation and adaptation strategies to minimize the public health impacts of climate change.

SCALING UP THE PROCESS OF GLOBAL DECARBONIZATION

The 28th Conference of the Parties of the United Nations Framework Convention on Climate Change (UNFCCC), held in Dubai, called for transitioning away from fossil fuels and accelerating action in this critical decade.[8] All countries must move rapidly toward net zero emissions and scale up their action to ensure achievement of the UNFCCC climate goals, viz., limiting the global temperature increase from preindustrial levels to preferably below 1.5 °C and definitely well below 2 °C.[9] However, there is increasing concern about whether the goal of limiting global warming to 1.5 °C remains achievable.[10,11] The major reason for such a concern is that global efforts to achieve carbon neutrality are not progressing as fast as they should to meet the 1.5 °C goal.[12,13] Meanwhile, emissions reduction and carbon dioxide removal (CDR) from the atmosphere are both necessary to limit climate change, but not a single country has seriously committed to carbon neutrality or net negative carbon through CDR, which is likely required at a large scale, as emissions are still increasing. However, planning and implementation of CDR should be carefully reviewed given its potential limitations and risks.[14]

The International Energy Agency revealed that, in 2023, global carbon dioxide (CO_2) emissions increased by 410 million tons, or 1.1%, compared with the year before.[15] CO_2 emissions in 2023 were at a record high, but clean energy deployment is also quickly growing. In fact, even as global prosperity grows, global CO_2 emissions are undergoing a structural slowdown. Removing all subsidies for fossil fuel development (and redirecting them toward renewable technologies) would speed up this process significantly. The International Monetary Fund estimated that total fossil-fuel subsidies in 2020 were $5.9 trillion (almost 7% of global gross domestic product).[16] If we can drastically reduce carbon emissions and end all subsidies for fossil fuels, then there is still hope for a sustainable and healthy future. This decade is critical. Governments at all levels, nongovernment organizations, private sectors, and the general public must mobilize and commit to speed up the process of global decarbonisation. To have the best chance at achieving the 1.5 °C goal, individuals, nations, and the global policy community should promote and implement the following seven essential actions (Box 1):

1. Scale up renewable energy and achieve carbon neutrality before the middle of this century (e.g., 2035). Technologies such as photovoltaic and wind power have rapidly advanced and are applicable in wealthy and low-middle-income countries as the economic cost of deploying them has been substantially reduced.[17] Additionally, we must actively look at large-scale ways to draw greenhouse gases (GHGs) from the atmosphere because current GHG emissions are still rising. Therefore, it is abundantly clear that we can build a climate resilient society and reverse any temperature overshoot above 1.5 °C if the investment in renewable energy is ramped up and atmospheric GHGs are drawn down through effective and sustainable "nature-based" GHG removal. Evidence suggests that the earlier commitment to carbon peaking and carbon neutrality is better for all countries in the world.[1−3]
2. Make a firm commitment to keeping global mean temperature rise below the 1.5 °C threshold to avoid catastrophic consequences of climate change. All countries, regardless of whether wealthy or poor, should strengthen emissions targets in their greatest capacity through collective stewardship, with assistance provided by wealthier countries to poorer countries to achieve these targets. The "loss and damage" and "least developed" funds in which rich countries provide financial assistance of $792 M and $129 M, respectively, to vulnerable countries would bring a significant benefit to socioeconomic development, particularly in those affected most by climate change.[8] Although these funds are far less than what vulnerable countries require, it is the first step on the right track.
3. Rapidly phase down licenses to extract fossil fuels and the construction of new fossil fuel exploration and infrastructure (e.g., gas pipelines, liquefied natural gas (LNG) terminals). In the meantime, we should facilitate the retirement of old and dirty coal plants. All existing and operational gas/coal plants must be equipped with carbon capture and sequestration (CCS) technology in the transition period toward the phase-out of fossil fuels. However, in certain regions characterized by low economic development and underdeveloped industrial sectors, the predominant source of energy is derived from the combustion of fossil fuels. For developing countries, especially those in the midst of rapid industrialization, the challenge lies in reconciling the pursuit of economic growth with the imperative of reducing carbon emissions as they move toward achieving carbon neutrality.

Box Box 1. Seven Essential Actions to Hasten Clean Energy Transitions

- Strive to achieve carbon neutrality before the middle of this century
- Tighten emissions targets and commit to keeping global mean temperature rise below the 1.5 °C threshold
- Stop extracting fossil fuels and the construction of new fossil fuel exploration and infrastructure
- Implement an international carbon price and remove all fossil fuels subsidies
- Adhere to sustainable lifestyles and healthy consumption behaviors
- Engage in transformative change to simultaneously act on climate, biodiversity, equity, human health and well-being
- Boost collective efforts and strengthen international cooperation

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Navigating the transition to sustainable energy sources remains a formidable task for these nations.

4. Implement an international carbon price that reflects the full range of negative externalities caused by emissions. Each major category of emissions should have specific national performance standards that should be tightened over time. A climate tax will encourage innovation by industry and other users to meet or exceed standards. We should also remove perverse subsidies that support the extraction and use of fossil fuels, and utilize these subsidies to support the development of renewable technologies and retraining of people for jobs in the green economy. The pain of transition resulted from a price on carbon policy we need for phasing out fossil fuels will be lessened.
5. Adhere to sustainable lifestyles and consumption behaviors at the individual level, which will make both families and the planet healthier. For instance, we should promote using public transport as an alternative to private vehicles for commuting, and walking or cycling for short-distance trips. Exercises such as walking, running, and cycling, for example, are not only part of a low-carbon lifestyle, but also have health benefits. Although food production has kept pace with global population growth, more than 820 million people have insufficient food and many more consume low-quality diets leading to micronutrient deficiencies and a substantial rise in obesity and noncommunicable diseases.[18] To improve both the environment and our health, it is recommended to consume more plant-based foods and less meat in our daily diet. Meanwhile, we should reduce daily waste (e.g., banning the manufacture of plastic bags/cups and single-use cutlery) and recycle all usable materials including batteries, metals, glass, and paper. A low-consumption lifestyle should be promoted and adopted as the social norm. We also need to reduce the environmental impact of our professional activities (e.g., purchase of equipment, international travel, and rational use of digital technologies such as artificial intelligence). Additionally, we must take a reflective approach to our research and training choices, and seek to positively impact the climate, biodiversity, and health.
6. All the sectors of society need to engage in a transformative change, defined by the International Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) as a fundamental, system-wide reorganization across technological, economic and social factors, including paradigms, goals, and values.[19] The response to the climate, biodiversity, and social crisis is not solely technological and behavioral. It requires a genuine reflection on values and the links between man and nature, and on the intra- and intergenerational solidarity, equity, and health. This could be grounded on a holistic vision to achieve well-being societies.[20,21]
7. Climate change and biodiversity loss are a defining global emergency, and well-coordinated collective efforts are imperative. International cooperation can boost the achievement of the Paris climate goals. Therefore, we should broaden communication channels and strengthen collaboration between the global south and north and across different sectors. Only by doing so, can we achieve the 1.5 °C warming target by the end of this century. Without swift and decisive action, climate change and biodiversity loss could have catastrophic consequences for humanity.

CONCLUSION

Evidently, climate change is one of the most pressing challenges human society faces, and we must unite to combat it. There will be many benefits including biodiversity protection, socio-economic development, ecosystem conservation, and human health, if we can limit global warming below 1.5 °C relative to preindustrial levels. We must accelerate the clean energy transition, and only doing so can the goal of limiting global warming below 1.5 °C still be achievable. Let us act now!

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S.T. wrote the paper. H.B., X.S., M.P., J.P. and E.L. contributed to revisions.

Notes

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Biography

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