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Promotion and protection of human rights: human rights questions, including alternative approaches for improving the effective enjoyment of human rights and fundamental freedoms

Promotion and protection of human rights in the context of climate change

Note by the Secretary-General

The Secretary-General has the honour to transmit to the General Assembly the report of the Special Rapporteur on the promotion and protection of human rights in the context of climate change, Elisa Morgera, in accordance with Human Rights Council resolution 57/31.

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Report of the Special Rapporteur on the promotion and protection of human rights in the context of climate change, Elisa Morgera

A human rights-based approach to the energy transition

Summary

The present report contains a synthesis of evidence of the positive and negative human rights impacts of renewable energy development and its reliance on minerals. It clarifies States' obligations and the responsibilities of other actors to support a human rights-based approach to the energy transition.

I. Introduction

1. Reliance on renewable energy enables the phasing out of fossil fuels, contributing to the most effective climate change mitigation action and preventing further widespread and severe impacts on human rights (see A/HRC/59/42). Transitioning towards renewables-based economies can also prevent toxic pollution, protect biodiversity and save $269 billion in health costs linked to air pollution, as underscored by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services in its 2024 thematic assessment report on the interlinkages among biodiversity, water, food and health ("nexus assessment"). In some settings, health savings are equal to climate mitigation costs.[1]

2. Renewable energy has already become the cheapest power option in most parts of the world. The cost of electricity from solar power fell by 85 per cent between 2010 and 2020, according to the International Renewable Energy Agency, in its report entitled *World Energy Transitions Outlook 2022: 1.5°C Pathway*. Renewables can contribute to energy security, employment, localized value addition and poverty reduction, improving access to energy for low- and middle-income communities (see A/75/181/Rev.1).[2]

3. There is no doubt about the invaluable role of renewable energy to protect human rights in the context of climate change. Nonetheless, violations of human rights to health, an adequate standard of living, development and a healthy environment in relation to certain sources and scales of renewables development and the "rush" to energy transition minerals have been documented in all regions of the world. Numerous testimonies contain references to severe negative impacts on Indigenous Peoples, persons of African descent and peasants and the replication of human rights violations and discriminatory practices that are well known in other extractive sectors (see A/78/155, A/HRC/24/41 and A/HRC/41/54).

4. Human rights harm in the context of renewables should be effectively prevented. Instead, disrespect for human rights is facilitated when renewables are exempted from, or subjected to lighter, planning requirements. Although a rapid energy transition is needed, such a transition should not be unchecked.

5. Prior assessments, planning and consultations are essential to draw on the best available science to select necessary measures to minimize negative impacts on the environment and prevent human rights harm. The human rights-based approach provides the evidence and norms to support States in fostering meaningful social dialogue and inclusive processes, which are considered necessary for system-wide transformations, according to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, in its 2024 assessment on transformative change.[3] Co-developing a just transition towards a safer climate jointly with the most affected human rights holders is also necessary to support thriving life-supporting systems for humanity, as emphasized by the Inter-American Court of Human Rights in its Advisory Opinion No. 32 of 2025 on the climate emergency.

6. The energy transition, therefore, should be pursued without replicating the same economic models and assumptions that underpin the fossil fuel-based economy and its role in bringing about the current planetary crises. Renewables should be

[1] Submission by the Global Climate and Health Alliance.

[2] See also submission by the Migration Youth and Children Platform.

[3] Karen O'Brien and others, *Thematic Assessment Report on the Underlying Causes of Biodiversity Loss and the Determinants of Transformative Change and Options for Achieving the 2050 Vision for Biodiversity of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services: Summary for Policymakers* (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2024).

developed as part of new economic models that prioritize equitable access to energy and energy efficiency, as well as the prevention of energy and resource overproduction and overconsumption and fossil fuel lock-in (see A/78/155 and A/HRC/59/42).[4] There are also other worrying links between renewables and fossil fuels, such as exemptions to coal-fired power plants for processing or recycling energy transition minerals[5] or reliance on plastics for renewable energy equipment and electric vehicles. In addition, climate disinformation and obstruction by the fossil fuel industry undermines public debate on renewables.[6]

7. The present report contains a synthesis of evidence of positive and negative human rights impacts of different sources and scales of renewables development, throughout their full life cycle, including reliance on minerals. The report was informed by a call for inputs and a series of consultations (see additional materials I). The Special Rapporteur on the promotion and protection of human rights in the context of climate change thanks participating States, national human rights institutions, civil society organizations, academics, Indigenous Peoples and other stakeholders for the over 100 submissions received. All inputs are available on the website of the Special Rapporteur, along with additional materials complementing the report.[7]

8. In the report, the Special Rapporteur clarifies States' international obligations, both individually and through international cooperation, and the responsibility of business enterprises and development finance institutions to support a just, effective and human rights-based energy transition (see A/HRC/53/24/Add.4 and A/HRC/56/55). That transition should go beyond technological substitution to address underlying inequities in energy production, consumption, distribution and governance and ensure access to energy where this is still lacking or insufficient to protect human rights (see Committee on Economic, Social and Cultural Rights, general comment No. 24 (2017) on State obligations under the International Covenant on Economic, Social and Cultural Rights in the context of business activities, E/C.12/DEU/CO/6 and E/C.12/BEL/CO/5).

II. Human rights impacts of the renewables sector

9. Access to energy is essential to protect human rights, notably civil and political rights, the rights to health and an adequate standard of living and the prevention of discrimination against women and girls, who are often primarily responsible for household energy use and fuel collection. In many places, because of assigned roles, women and girls face disproportionate burdens related to fuel scarcity, energy costs and exposure to health risks from indoor air pollution caused by inefficient and unsafe cooking methods (Committee on the Elimination of Discrimination against Women, general recommendation No. 34 (2016) on the rights of rural women, paras. 81–85). Access to renewables has also been linked to the protection of children's rights, including education (see CRC/C/MHL/CO/3-4). Renewables development projects that pay fair compensation, fairly share profits, provide alternative livelihoods and adequately build local capacities can have positive impacts on human rights, societies and economies.

10. Renewables development can be designed to contribute to poverty eradication and combat social exclusion, by reducing the retail price of electricity, providing

[4] See also submission by the Centre for Research on Multinational Corporations (SOMO).
[5] Submission by Greenpeace Southeast Asia.
[6] Matthew Einsenson and others, "Rebutting 33 false claims about solar, wind and electric vehicles", paper prepared for the Sabin Center for Climate Change Law, April 2024.
[7] See www.ohchr.org/en/calls-for-input/2025/call-inputs-human-rights-life-cycle-renewable-energy-and-critical-minerals.

better-quality and more gender-balanced jobs than the fossil fuels industry and supporting energy access in rural areas and decentralization that better responds to low-income households' needs (see A/75/181/Rev.1).

11. The United Nations Working Group on business and human rights, however, identified recurrent issues in the energy transition, such as regulatory gaps and a lack of access to information, meaningful participation or effective remedies for victims (see A/78/155). More negative impacts on human rights also exist.

A. Unfair sharing of benefits and discrimination

12. United Nations special procedure mandate holders have documented experiences of exclusion from economic benefits of renewables projects. For instance, a large solar-power project in Botswana left 30 per cent of rural households without access to electricity, even if they were situated very close to powerlines (see A/HRC/55/43/Add.2). Renewables development should also consider pre-existing patterns of social and economic exclusion that are linked to human rights abuses in the extractive sector; otherwise, marginalized individuals and groups will be unable to share fairly in economic opportunities, technologies and financing to establish renewables ventures (see A/78/155). This understanding is also essential for State and non-State actors facing opposition to renewables projects that reinforce racial, ethnic and gender inequality (see A/HRC/41/54).

B. Environmental harm

13. Several submissions contain references to experiences involving a lack of or poor access to information and exemptions from environmental impact assessments justified by the "overriding public interest" nature of large-scale renewables projects (see also A/80/187). In addition, there is a trend in national legislation for biodiversity, water and toxics concerns to be poorly integrated into the planning of large-scale renewables, particularly offshore projects.[8] These instances undermine civil and political rights and limit opportunities to take practicable steps to prevent foreseeable ecological harm and protect the rights to life, health, food, water, livelihoods, housing and a healthy environment, as well as cultural rights. As a result, there are increasing threats and attacks against environmental human rights defenders in this sector.[9]

C. Women and children

14. Women and children, especially girls, face heightened risks and disproportionate impacts from unsustainable renewables projects, including gender-based violence.[10] Women, who are often primary caregivers and tend to be more dependent on land for household needs and livelihoods, face increased burdens when water sources are depleted, lands are expropriated or communities are forcibly evicted to set up renewables projects.[11] Children are more vulnerable to negative impacts on aquatic ecosystems, agriculture and fisheries resulting in waterborne diseases and

[8] Niko Soininen and others, "Offshore wind power through the lenses of EU climate, energy and environmental law", *Ocean Development and International Law* (forthcoming).

[9] Submissions by Swedwatch, Greenpeace, the Asia Pacific-Transition Mineral Accountability Working Group and the Indian Law Resource Center.

[10] Submissions by the International Council on Mining and Metals (ICMM) and Ayat Allah Bouramdane.

[11] Submission by Namati.

malnutrition (see Committee on the Rights of the Child, general comment No. 26 (2023) on children's rights and the environment, with a special focus on climate change). In addition, women and children are less likely to be included in consultation due to patriarchal traditions. Excluding women and girls from decision-making, however, misses the opportunity to integrate distinctive understandings of enhanced energy access as a precondition for care work, poverty reduction and social justice (see A/68/293), environmental stewardship and relations of care (see A/HRC/51/28 and A/HRC/52/33).[12] All of these elements are considered indispensable by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services for transformative change that enhances human and planetary well-being.

D. Workers

15. Violations of workers' rights to freedom of association, collective bargaining and occupational health and safety have been reported in the renewables sector. So have child labour, exposure to toxic substances and dangerous work underground or under water, particularly for migrant children.[13] There is also increasing evidence that renewable energy supply chains rely on forms of modern slavery, including forced labour, wage theft and unlawful overtime.[14] It has been reported that 35 per cent of the global supply of silicon for the solar industry comes from the Xinjiang Uighur Autonomous Region in China, where these allegations have been made.[15]

E. Indigenous Peoples

16. Indigenous Peoples' rights are particularly affected by a lack of access to information, free, prior and informed consent processes and fair and equitable benefit-sharing in large-scale renewables projects and related mining. The latter is especially worrying, as the International Renewable Energy Agency has estimated that more than 50 per cent of energy transition minerals are found in Indigenous territories.[16] These harmful practices have been extensively documented by the Special Rapporteur on the rights of Indigenous Peoples in other extractive sectors (see A/HRC/21/47 and A/HRC/24/41). Even when consultations occur, developers bypass customary decision-making processes or threaten or attack Indigenous representatives who question irregularities in permission processes (see A/HRC/39/17/Add.2). In addition, benefit-sharing negotiations are held in bad faith, with a view to dividing

[12] See also Nora Götzmann and Mathilde Dicalou, *Towards a Feminist Energy Justice Framework: Women's Participation in the Energy Transition in Sub-Saharan Africa* (Copenhagen, Danish Institute for Human Rights, 2023); and Gina Cortés Valderrama, *Transiciones Justas, Feministas y Soberanas: Repensando el Financiamiento Climático en el Sur Global* (Lima, Latindadd, 2025).

[13] Submissions by Greenpeace, the Business and Human Rights Resource Centre and the Migration Youth and Children Platform.

[14] Submission by Walk Free (Australia); and Anne Line Sigsgaard Berg and others, *Human Rights and Solar Energy: A Primer for the Danish Solar Energy Sector* (Copenhagen, Danish Institute for Human Rights, 2025).

[15] Sigsgaard Berg and others, *Human Rights and Solar Energy*; submission by the Uniting Church in Australia and others; communication CHN 18/2020, available at https://spcommreports.ohchr.org/Tmsearch/TMDocuments; Office of the United Nations High Commissioner for Human Rights (OHCHR) "OHCHR assessment of human rights concerns in the Xinjiang Uyghur Autonomous Region, People's Republic of China", 31 August 2022; and Alan Crawford and Laura T. Murphy, *Over-Exposed: Uyghur Region Exposure Assessment for Solar Industry Sourcing* (Sheffield, United Kingdom of Great Britain and Northern Ireland, Sheffield Hallam University, 2023).

[16] See www.irena.org/Digital-Report/Geopolitics-of-the-Energy-Transition-Critical-Materials. See also A/78/155.

communities; there is no room for Indigenous Peoples' world views to shape the project and its benefits; and agreed benefits do not materialize or, when they do, they are minimal, such as scarce or low-level employment opportunities.

17. It is imperative to understand the violations of Indigenous Peoples' human rights related to renewables as the latest in a series of extractive activities, conservation initiatives and climate actions that have violated their rights over generations, in cumulative ways (see A/70/301, A/HRC/24/41, A/HRC/36/46 and A/HRC/54/31), further degrading ecosystems vital to their survival, cultural identity and livelihoods. This is also a "double burden" placed on Indigenous Peoples, as they are not only among those most affected by climate change, but also expected to bear the negative impacts of mitigation efforts.[17]

18. Violations are more frequent when domestic legal frameworks are not aligned with international law on Indigenous Peoples' human rights. In many countries, Indigenous Peoples themselves are not recognized, their territories are not demarcated or Indigenous communities (notably, pastoralist or nomadic) are absent from public registries and land-use planning maps. There are often contradictions across domestic legal systems that undermine the protection of their rights. Protection is often inadequate for Indigenous Peoples in voluntary isolation.[18]

19. The violations of Indigenous Peoples' rights in the context of renewables are also the result of disregard for – or a lack of genuine engagement with – Indigenous science in developing climate solutions that are aligned with planetary health and all the interlinked substantive dimensions of the human right of all people to a healthy environment. Paradoxically, violations of Indigenous Peoples' rights erode the material and immaterial conditions for Indigenous science to evolve, by preventing its being practised in the territories and transmitted to future generations. When shared with humanity, Indigenous knowledge can inform just transition planning,[19] thus supporting transformative change, as underscored by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

F. Peasants

20. Several submissions and civil society reports included allegations of land grabs, displacement and destruction of biodiversity, sacred sites and cultural heritage in the context of large-scale renewables projects and mining on the territories of traditional farmers and small-scale fishers, providing evidence of how these violations also undermined their resilience in the context of climate change (see communication CHN 8/2024).[20] Forced evictions and forced displacement should, as a principle, be avoided, as they are a prima facie human rights violation; if confirmed, they constitute a gross violation of human rights (see A/HRC/4/18 and Commission on Human Rights resolution 1993/77).

21. Even when there are negotiations prior to resettlement, communities experience inadequate compensation, substandard relocation housing, corruption in the distribution of resettlement funds and the exacerbation of precarious migration patterns (see A/79/317 and A/HRC/4/18, annex I). National laws often do not offer sufficient

[17] Submission by the Saami Council.

[18] Submissions by the Grupo de Trabajo Internacional para la Protección de Pueblos Indígenas en Aislamiento y Contacto Inicial and by Landesa and the International Land Coalition.

[19] "Indigenous Peoples principles and protocols for just transition", document adopted at the Just Transition: Indigenous Peoples' Perspectives, Knowledge, and Lived Experiences summit, Geneva, October 2024.

[20] All communications mentioned in the present report are available at https://spcommreports.ohchr.org/Tmsearch/TMDocuments.

and coherent recognition and protection of collective or traditional tenure rights (see Committee on Economic, Social and Cultural Rights, general comment No. 26 (2022) on land and economic, social and cultural rights and Committee on the Elimination of Discrimination against Women, general recommendation No. 34 (2016)).

22. This is also a missed opportunity to co-develop renewables projects with local knowledge holders, considering the growing evidence of the human rights, climate and socioeconomic benefits of community- and women-led renewables.[21]

G. Inequitable benefit-sharing among States

23. There are also human rights considerations in international cooperation, particularly in relations with States that are high consumers of energy and minerals. Increasing evidence points to neocolonial patterns of renewables development, locking regional and national economies into development dependencies of primary extraction, land expropriation, elite capture and unsafe disposal of toxic waste,[22] while disproportionate benefits accrue to other nations. These global patterns of structural discrimination contravene the jus cogens norms on the right to self-determination and on racial discrimination (see A/77/549). International cooperation is essential to ensure fair benefit-sharing among States resulting from the energy transition, specifically targeting the nearly 700 million people worldwide still lacking in access to electricity, three quarters of whom are located in sub-Saharan Africa.

H. Conflicts and organized crime

24. Armed conflicts cause severe damage to renewable energy production facilities, including in occupied territories.[23] Conflicts over the acquisition and use of land for renewables projects and mining are a significant occurrence.[24] There is also evidence of collusion between elites and organized crime groups involved in illegal mining, corruption and money-laundering.[25]

III. The full life cycle of renewables

25. According to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, assessing the full life cycle of renewables at the nexus of climate, nature, food, water and health avoids escalating resource competition and ecological degradation. “Nexus thinking” helps to prevent human rights harm, in line with all the substantive dimensions of the human right to a healthy environment. A life cycle approach is needed to ensure full consideration for the negative impacts of climate change on renewables sources and infrastructure: an increasing number of industrial accidents in the renewables and transition minerals sectors (see ECE/CP.TEIA/2024/2), for instance, threatens workers’ health and safety, the health and well-being of directly affected communities and the right of all people to development.

26. Life cycle assessments should rely on best available science, including Indigenous science and local knowledge, across climate, biodiversity, toxics and human and planetary health concerns (see A/79/176). They should be participatory and genuinely inclusive of the lived experiences of those most affected by climate

[21] Submission by Landesa and the International Land Coalition.
[22] Submission by Susan Park, Sydney Environment Institute, University of Sydney.
[23] Submission by Association of Reintegration of Crimea.
[24] Submission by the Legal Initiative for Forest and Environment.
[25] Submission by Namati.

change and by existing renewables projects, to ensure consideration of intersectionality (see A/HRC/56/46) and fill any information gaps on climate change and human rights (see A/79/176).

A. Wind power

27. The continuous growth of renewable power generation is driven by wind energy, which is second only to solar energy, according to the International Renewable Energy Agency, in its *Renewable Energy Statistics 2025*. Wind energy contributes to climate change mitigation and air pollution reduction, as well as to combating desertification and land degradation.[26] Wind is considered less socially and environmentally risky and less resource-intensive than other renewables.[27]

28. Large-scale wind farms, however, can have a negative impact on biodiversity, coastal sediment flow and freshwater availability. Mortality of birds and bats has been significantly mitigated by turbine design, placement and operation.[28] Concerns about biodiversity, soil and water, however, remain when wind farms are placed in ecologically sensitive areas. There are also concerns about impacts on the right to health due to noise, which can lead to depression, insomnia and emotional distress.[29]

29. Human rights concerns have been documented by United Nations special procedure mandate holders. For instance, in Mexico, economic and social rights were negatively affected by large-scale wind projects with the capacity to produce electricity for millions of people, which did not provide more affordable energy prices or access to reliable electricity for nearby communities. It has been reported that the jobs created during the construction phase were temporary, sometimes of only a week in duration, and poorly paid (see communications MEX 13/2021 and OTH 210/2021). In Norway, allegations were made about the construction of wind parks without free, prior and informed consent, which caused negative impacts on legally protected traditional migration routes of reindeer and on Indigenous Peoples' economic, social and cultural rights (see communication NOR 2/2021).

30. The production of e-waste from wind energy is an increasing environmental and human rights issue, even if it is roughly 1,000 times less than waste from coal ash.[30] Countries in the Asia-Pacific region often bear the environmental and human health costs of renewables recycling operations, without equivalent technological or economic benefits.[31]

B. Solar power

31. Solar power is dominating renewables growth. It can be deployed in different environments, from ground-mounted panels in rural areas to panels integrated into the built environment. Although large-scale solar power requires significant land area,

[26] Hans-Otto Pörtner and others, "IPBES-IPCC co-sponsored workshop: biodiversity and climate change – workshop report", Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services and Intergovernmental Panel on Climate Change, 2021.

[27] Asian Peoples' Movement on Debt and Development and others, "Ten principles for the rapid, equitable, and just transition to renewable energy systems", 2025.

[28] Hans-Otto Pörtner and others, *IPBES-IPCC Co-sponsored Workshop: Biodiversity and Climate Change – Scientific Outcome* (Bonn, Germany, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services secretariat, 2021).

[29] Submission by Alianza por los Humedales Andinos.

[30] Einsenson and others, "Rebutting 33 false claims about solar, wind and electric vehicles".

[31] Submissions by the Global Alliance on Incinerator Alternatives – Asia-Pacific and by Greenpeace Southeast Asia.

this is estimated to be significantly lower than for fossil-fuel power plants and more efficient than for bioenergy. Moreover, integrated solar-cropping or grazing systems can support multiple land uses, with positive spillover effects into neighbouring areas if habitats for pollinators are created underneath solar panels.[32] Agrophotovoltaics – elevated solar-power panels in agricultural land that provide shading to the crops beneath them – preserve soil moisture and reduce drought stress, thereby representing an adaptation-mitigation strategy that can provide additional income to rural households (see A/75/181/Rev.1).

32. The development of large-scale solar parks entails changes for ecosystems, but significant impacts can be mitigated through planning, siting and the creation of wildlife corridors. The water consumption of solar farms is one of the lowest among all renewables, but the water requirements to clean solar panels exposed to dust in arid regions can increase competition for water with other uses of it, especially in areas affected by water scarcity. A potential large-scale deployment of solar farms in a relatively limited area (e.g. over the Sahara Desert) has the potential to affect global cloud cover formation, change precipitation patterns and increase surface temperature.[33]

33. There remain concerns about the lack of appropriate consultation with potentially affected communities and their involvement in the identification of mitigation measures for large-scale solar power. For instance, in Honduras, the construction of a solar power plant by a Norwegian company was initiated without proper consultation with affected communities and had significant risks for biodiversity and water sources. Environmental human rights defenders were attacked and intimidated (see A/HRC/40/60/Add.2).

34. Off-grid, distributed or mini-grid solar panels improve energy access,[34] especially in remote areas where large-scale on-grid energy production is not cost-effective, protecting the rights to education, health and livelihoods (see A/75/181/Rev.1). There are, however, a variety of reasons – technical limitations, internal company policies and a lack of public incentives – that undermine the mini-grid sector, such as a lack of support for hybrid partnership models recognizing the role of communities as active participants in site selection, with the aim of enhancing community livelihoods while optimizing mini-grid capacity and environmental stewardship.[35]

35. Increasing environmental and human rights issues surround the production of e-waste from solar energy, with much remaining unrecycled. Economic incentives currently favour landfill disposal over recycling.[36] Even individual households are incentivized to replace their solar panels early, when better-performing systems become available.[37] The cumulative value of recoverable materials from solar panels is projected to reach $450 million by 2030. Advanced recycling technologies, which can be used to recover over 90 per cent of materials from solar panels, are, however, available and should be shared with countries that lack relevant technological

[32] Pörtner and others, *IPBES-IPCC Co-sponsored Workshop: Biodiversity and Climate Change – Scientific Outcome*.

[33] Vasilis Fthenakis and others, “Large photovoltaic power plants: wildlife impacts and benefits”, *2011 37th IEEE Photovoltaic Specialists Conference* (Seattle, United States of America, Institute of Electrical and Electronic Engineers, 2011).

[34] Chelsea Schelly and others, “Energy policy for energy sovereignty: can policy tools enhance energy sovereignty?”, *Solar Energy*, vol. 205 (15 July 2020).

[35] See https://africaminigrids.org/libraries/harvesting-sunshine-how-productive-uses-of-minigrid-electricity-make-farmers-richer-and-energy-cheaper/.

[36] Benjamin K. Sovacool and others, “Towards improved solar energy justice: exploring the complex inequities of household adoption of photovoltaic panels”, *Energy Policy*, vol. 164 (May 2022).

[37] Dustin Mulvaney, “Opening the black box of solar energy technologies: exploring tensions between innovation and environmental justice”, *Science as Culture*, vol. 22, No. 2 (2013).

capacity. Another proposed approach is collaboration between neighbouring countries and cities to pool resources, establish local recycling centres and minimize transportation costs.[38]

C. Marine renewables

36. Offshore wind, wave and tidal energy are already operating at a commercial stage, with offshore solar platforms being forecasted as the most promising.[39]

37. Impacts common to all marine renewables are the generation of underwater noise and electromagnetic fields, which may harm marine life.[40] There can also be impacts on the local climate, such as alteration in clouds that reduce precipitation levels and affect ocean salinity, due to the large surface area occupied and the temperature difference between the hot surface of the photovoltaic panels and the surrounding air. The extent and nature of these impacts remain unclear: more research is needed to understand the full life cycle of these technologies.

38. It is necessary to give full consideration to the paramount importance of the ocean for human rights (see A/HRC/58/59) and to the multiple pressures on ocean health, including climate change and ocean acidification, as well as to power imbalances in ocean governance for Indigenous Peoples and small-scale fishers (see A/HRC/55/49). Marine spatial planning is a crucial process to ensure participatory and inclusive approaches that protect human rights, prioritizing the needs of the most vulnerable and tackling conflicts of interest[41] in considering the full life cycle of proposed marine renewables.

D. Geothermal power

39. Geothermal energy is a location-specific energy source that can be used for electricity generation, heating and cooling. According to the International Energy Agency report entitled *Renewables 2024: Analysis and Forecast to 2030*, geothermal energy holds a significant share in the power mixes of many countries and is anticipated to remain important in those economies through 2030.

40. To minimize air and water pollution risks (see A/HRC/54/25), it is possible to filter out harmful emissions from surface steam from geothermal plants[42] and ensure consistent reinjection of harmful discharges. Careful design, quality control and monitoring can prevent the pollution of groundwater due to improper liquid discharge or permeable storage ponds.[43]

41. The biological, chemical and geological features of geothermal sites can support the development of unique and sensitive ecosystems, so geothermal energy resources

[38] Submission by CarbonCare InnoLab.

[39] Sheng Wu and others, “Discussion on the development of offshore floating photovoltaic plants, emphasizing marine environmental protection”, *Frontiers in Marine Science*, vol. 11 (2024).

[40] Santiago Salvador and Marta Chantal Ribeiro, “Socio-economic, legal, and political context of offshore renewable energies”, *WIREs Energy and Environment*, vol. 12, No. 2 (March/April 2023).

[41] Nathan J. Bennet, Elisa Morgera and David Boyd, “The Human Right to a Clean, Healthy and Sustainable Ocean”, *npj Ocean Sustainability*, vol. 3 (2024).

[42] Abdek Mahamoud Abdi and others, “Social acceptance and associated risks of geothermal energy development in East Africa: perspectives from geothermal energy developers”, *Clean Energy*, vol. 8, No. 5 (October 2024).

[43] Ronald DiPippo, “Geothermal energy electricity generation and environmental impact”, *Energy Policy*, vol. 19, No. 8 (October 1991).

are often located in protected areas.[44] Deforestation in these areas can disturb hydrological cycles, which risks affecting irrigation and the recharge of geothermal sources.[45] Specific requirements for siting, system design, biodiversity mitigation measures and monitoring can help to minimize environmental impacts.[46] That said, "no-go zones" have been advocated, particularly for areas prone to seismic activity.[47]

E. Hydropower

42. Hydropower is currently the highest renewables generation source; it is expected to provide more than half of the electricity generation in China, India, other South-East Asian countries and Africa in 2030, according to the International Energy Agency *Renewables 2024* report.

43. However, hydropower development causes significant environmental and human rights harm, from community displacement to biodiversity and cultural heritage loss. Human rights violations affecting life, health, livelihoods, housing, a healthy environment, development and cultural rights, have been amply documented by United Nations human rights experts and mentioned in several submissions (see additional materials II). For instance, the construction of a large-scale hydroelectric dam in the Philippines displaced Indigenous Peoples and was located on geologically instable lands, with risks for a shortened dam lifespan or even catastrophic failure. It did not include mitigation for negative impacts on migratory fish and the right to food for upstream communities (see A/HRC/56/46/Add.2). According to the Business and Human Rights Resource Centre, over the past decade, there were at least 389 attacks on human rights, labour and environmental defenders related to hydropower projects globally.

44. In addition, the economic and financial viability, efficiency and carbon-reducing potential of hydropower dams has been increasingly questioned, particularly when placed in areas that are vulnerable to climate change, which causes unpredictable water flows and greater siltation that threaten the structural integrity and productivity of dam structures.[48] There is growing evidence of the failure to properly assess and mitigate human and environmental impacts and of the frequent overestimation of actual power output levels, of operational hydropower projects.[49]

45. In terms of climate mitigation, it is necessary to account for:

(a) Reservoirs being significant sources of methane, a potent greenhouse gas, whose rising emissions account for an increase of 0.5°C in average global temperatures since the late 1800s;[50]

[44] Madjid Soltani and others, "Environmental, economic, and social impacts of geothermal energy systems", *Renewable and Sustainable Energy Reviews*, vol. 140 (April 2021); and submission by a coalition of Indonesian civil society organizations.

[45] Christian Griebler and others, "Potential impacts of geothermal energy use and storage of heat on groundwater quality, biodiversity, and ecosystem processes", *Environmental Earth Sciences*, vol. 75 (2016).

[46] Michał Kaczmarczyk, Anna Sowiżdżał and Barbara Tomaszewska, "Life cycle and water footprint assessment in the geothermal energy sector", *Energies*, vol. 17, No. 23 (2024).

[47] Asian Peoples' Movement on Debt and Development and others, "Ten principles".

[48] Submission by International Rivers.

[49] Laura Castro-Diaz and others, "Impacts of hydropower development on locals' livelihoods in the Global South", *World Development*, vol. 169 (September 2023).

[50] John. A. Harrison and others, "Year-2020 global distribution and pathways of reservoir methane and carbon dioxide emissions according to the greenhouse gas from reservoirs (G-res) model", *Global Biogeochemical Cycles*, vol. 35, No. 6 (June 2021).

(b) Greenhouse gas emissions from large-scale reservoirs over their lifetimes, including emissions from decaying organic matter in flooded areas, particularly in warmer or tropical climates;[51]

(c) Lost habitat carbon storage, in downstream or contiguous tropical forests, peatlands and mangroves, which have the highest carbon stocks per hectare of all natural terrestrial and coastal ecosystems, and in flooded areas;[52]

(d) Impacts of climate change on the hydrological cycle and on wetlands;[53]

(e) Greenhouse gas emissions at end-of-life hydropower stations;[54]

(f) Human displacement resulting in higher-emissions lifestyle changes by riverside communities that relocate or commute to cities.[55]

46. That evidence raises the question as to whether new hydropower plants should be built at all,[56] in particular on transboundary rivers due to the risks of increased inter-State conflicts.[57]

47. Smaller-scale hydropower, if well-managed and coordinated on a river basin level, can have lower environmental impacts, can be more amenable to community ownership [58] and can provide energy security to isolated and marginalized communities.[59] Attention should, nevertheless, be paid to biodiversity impacts,[60] such as habitat fragmentation and degradation, larger transport infrastructural requirements and cumulative impacts. Impacts may be reduced by low-speed turbines and ecological assessment methods.[61]

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[51] United Nations Educational, Scientific and Cultural Organization (UNESCO), *The United Nations World Water Development Report 2020: Water and Climate Change* (Paris, 2020); and Bridget R. Deemer and others, "Greenhouse gas emissions from reservoir water surfaces: a new global synthesis", *BioScience*, vol. 66, No. 11 (1 November 2016).

[52] Cordula Epple and others, *Managing Ecosystems in the Context of Climate Change Mitigation: A Review of Current Knowledge and Recommendations to Support Ecosystem-Based Mitigation Actions that Look beyond Terrestrial Forests*, CBD Technical Series No. 86 (Montreal, Canada, Secretariat of the Convention on Biological Diversity, 2016).

[53] UNESCO, *United Nations World Water Development Report 2025: Mountains and Glaciers – Water Towers* (Paris, 2025); and Mauricio E. Arias and others, "Impacts of hydropower and climate change on drivers of ecological productivity of Southeast Asia's most important wetland", *Ecological Modelling*, vol. 272 (24 January 2014).

[54] Arun Kumar and others, "Hydropower", in *Renewable Energy Sources and Climate Change Mitigation: Special Report of the Intergovernmental Panel on Climate Change*, Ottmar Edenhofer and others, eds. (Cambridge, United Kingdom, and New York, United States, Cambridge University Press, 2011).

[55] Sankesha P. Bhoyar and others, "Understanding the impact of lifestyle on individual carbon-footprint", *Procedia – Social and Behavioral Sciences*, vol. 133 (15 May 2014).

[56] Atif Ansar and others (2014), "Should we build more large dams? The actual costs of hydropower megaproject development", *Energy Policy*, vol. 69 (June 2014).

[57] Isobel Edwards, "The role of decentralized renewable energy in peacebuilding" (Geneva, Quaker United Nations Office, 2018).

[58] Dan Virah-Sawmy and Bjorn Sturmberg, "Socio-economic and environmental impacts of renewable energy deployments: a review", *Renewable and Sustainable Energy Reviews*, vol. 207 (January 2025).

[59] Simone Athayde, and others, "Improving policies and instruments to address cumulative impacts of small hydropower in the Amazon", *Energy Policy*, vol. 132 (September 2019).

[60] Kaisa Huhta, Niko Soininen and Sita Vesa, "The ecological sustainability of the energy transition in EU law: pro et contra hydropower", *Journal of Energy and Natural Resources Law*, vol. 43, No. 1 (2025); and Antti Iho and others, "Rivers under pressure: interdisciplinary feasibility analysis of sustainable hydropower", *Environmental Policy and Governance*, vol. 33, No. 2 (April 2023).

[61] Pörtner and others, *IPBES-IPCC Co-sponsored Workshop: Biodiversity and Climate Change – Scientific Outcome*.

F. Bioenergy

48. Bioenergy is a form of renewable energy sourced from biomass, namely, organic material derived from living or recently living organisms or their waste. Bioenergy is currently one of the largest sources of renewable energy worldwide (50 per cent).[62] But questions remain about its effective contributions to climate change mitigation: greenhouse gas savings are overestimated, including with regard to those due to large carbon emissions from clearing forests to create space for plantations and from indirect land use change, such as forest clearances by people displaced by plantations.[63]

49. Bioenergy production can be water- and land-intensive and may rely on fertilizers that, when overused, leads to risks of water contamination (see A/HRC/54/25). Plantations have a negative impact on soil fertility, erosion risk, soil carbon and freshwater ecosystems,[64] in turn negatively affecting biodiversity and the right to food (see A/62/289). Second-generation bioenergy from agricultural residue, grasses and straw, forest waste or inedible oils (such as jatropha) can be grown on marginal land rather than agricultural land and use less water. Third-generation bioenergy from microalgae may have potentially fewer environmental impacts, because of reliance on recycled water and the absence of pesticide use, but further improvements in technologies and production methods are still required. In the latter two cases, production costs are quite high.[65]

IV. Reliance on minerals

50. Solar photovoltaic systems, wind turbines, electrolysers, batteries, fuel cells and residential heat pumps all rely on "critical" or energy transition minerals, with lists differing from country to country.[66] The label "critical" is assigned for two reasons: these minerals have considerable economic importance for consumer countries; and they entail a high supply risk, as their unique properties mean that viable substitutes are lacking.[67] On the one hand, consumer countries focus on developing their processing capabilities; on the other, several mineral-rich States have adopted commodity-specific measures to maximize local economic benefits, promoting domestic processing as a route to industrialization.[68]

51. Lithium, cobalt, nickel, graphite, manganese, copper, zinc, aluminium and rare earth elements are used for electric vehicles and battery storage. Silicon, cadmium, tellurium and selenium help in building solar panels. Wind power requires copper. Hydropower uses copper, chromium, zinc and aluminium.[69] Although sourced from various locations globally, these minerals, and their procurement and trade, are

[62] See www.iea.org/energy-system/renewables/bioenergy.
[63] See www.eca.europa.eu/ECAPublications/SR-2023-29/SR-2023-29_EN.pdf.
[64] Submissions by the Biomass Action Network and the Saami Council.
[65] Shahid Ahmad Padder, Rabia Khan and Rauoof Ahmad Rather, "Biofuel generations: new insights into challenges and opportunities in their microbe-derived industrial production", *Biomass Bioenergy*, vol. 185 (June 2024).
[66] See https://unece.org/sites/default/files/2024-04/RMYMG%20-%20Critical%20Minerals%20for%20Sustainable%20Energy%20Transition%20-%20A%20Guidebook%20to%20support%20Intergenerational%20Action.pdf.
[67] Seita Vesa, "Critical raw materials in the Anthropocene: regulatory perspectives on their promise and pitfalls" in *Climate Technology and Law in the Anthropocene*, Leonie Reins and Alexander Zahar, eds. (Bristol University Press, 2025).
[68] Lorenzo Cotula, "Critical minerals: international economic law in a global resource rush", *Trade, Law and Development*, vol. 15, No. 2 (winter 2023).
[69] See www.un.org/sites/un2.un.org/files/report_sg_panel_on_critical_energy_transition_minerals_11_sept_2024.pdf.

concentrated in certain countries and regions. Most lithium is extracted in Australia and in the triangle between Argentina, Bolivia (Plurinational State of) and Chile; rare earths in China; nickel in Indonesia; and cobalt in the Democratic Republic of the Congo. China controls most of the graphite, rare earth, cobalt and lithium processing (see A/HRC/54/25).

52. The potential for global growth in demand for those minerals is estimated to rise to six times the current levels by 2040, according to the 2021 special report of the International Energy Agency on the world energy outlook, entitled "The role of critical minerals in clean energy transitions". These projections are currently driving infrastructure planning, mining licensing, trade and investment policies, both nationally and internationally. Those minerals, however, are used not only for the energy transition, but also for electronics, robotics, communication technologies, defence and aerospace,[70] so there are underlying concerns about sustaining production and consumption that are unrelated to climate mitigation or may even run counter to climate mitigation purposes. Furthermore, demand projections – and their underlying assumptions – have not been sufficiently analysed.[71] Projections can vary significantly depending on expectations about recycling, substitution and technological development: almost all studies disagree on the scale, timeline and rate of demand increase, as well as on which technologies will supply energy needs.[72] For instance, wind turbines might require between 1 and 10 tons of copper, depending on the study. What is more, advances in battery chemistry, such as the development of sodium-ion and low-cobalt lithium-ion alternatives, could significantly reshape mineral demand patterns.[73] Few models account for how the energy used in recycling will be sourced, but the recycling process itself is energy-intensive and difficult to decarbonize.[74]

53. Meanwhile, mining entails significant environmental harm. Lithium extraction has led to serious water depletion, harming wetlands, groundwater and plant and animal species that are important for food and textiles, negatively affecting Indigenous Peoples' rights to water, an adequate standard of living, food, health and a healthy environment and cultural rights.[75] Nickel mining has caused toxic pollution, land degradation and cultural loss, with nearby residents suffering from respiratory and skin diseases, headaches, urinary tract infections and eye irritation.[76] Copper mine tailings dam failure results in long-term impacts on the watershed and on human health.[77] Mineral sands mining is not environmentally sustainable and contributes substantially to greenhouse gas emissions.[78]

54. Mining can be accompanied by large-scale deforestation, pollution of freshwater sources (due to sedimentation caused by dredging) and increased floodings. At the processing and transport stages, risks include air and water contamination. At the decommissioning stage, failures to adequately rehabilitate a project site and properly restore tenure rights to local communities can result in several adverse impacts on human rights. Abandoned extraction sites and ongoing toxic discharges from mining

[70] See https://desapublications.un.org/sites/default/files/publications/2025-01/WESP%202025_Harnessing%20the%20Potential%20of%20Critical%20Minerals%20for%20Sustainable%20Development_WEB.pdf.

[71] Submission by the Environmental Defenders Office.

[72] Jordan Lee Calderon and others, "Critical mineral demand estimates for low-carbon technologies: what do they tell us and how can they evolve?", *Renewable and Sustainable Energy Reviews*, vol. 189 (January 2024).

[73] See https://unctad.org/system/files/official-document/ditccom2025d1_en.pdf.

[74] Benjamin K. Sovacool and others. "Sustainable minerals and metals for a low-carbon future", *Science*, vol. 367, No. 6473 (3 January 2020).

[75] Submissions by Climate Law in International Context and Alianza por los Humedales Andinos.

[76] Submission by the Securing Indigenous Peoples' Rights in the Green Economy coalition.

[77] Submission by Amnesty International.

[78] Submission by the Alliance for Responsible Mining Regulation.

operations create long-term environmental and health hazards, including soil contamination, groundwater pollution and ecosystem degradation.

55. Civil society organizations have recorded 630 allegations of human rights impacts between 2010 and 2023 in the mining of seven energy transition minerals, with 51 per cent of allegations involving 10 companies.[79] Between 2021 and 2023, their extraction was linked to 334 incidents of violence or protest.[80]

56. Mining should be limited to what is essential for the energy transition, as a form of protection of human rights in the context of climate change, taking into account local, inter-State and global environmental impacts according to an ecosystem and human rights-based approach. It should be managed responsibly and carried out sustainably[81] and equitably. It is also necessary to consider the full life cycle of energy transition mining, including how extraction and processing produce a significant proportion of greenhouse gas emissions,[82] as does mineral recycling of electric vehicles batteries.[83]

57. In its 2024 report, entitled "Resourcing the energy transition: principles to guide critical energy transition minerals towards equity and justice", the United Nations Secretary-General's Panel on Critical Energy Transition Minerals included as the first principle that human rights must be at the core of all mineral value chains. United Nations Special procedure mandate holders clarified that international human rights norms must inform the application of all the seven principles included in the Panel's report and that States should give full consideration to the universal, interdependent, inherent and indivisible nature of human rights. Accordingly, States should undertake, in the first instance, a prior strategic comprehensive independent assessment, based on the best available science, of the need for minerals and of alternatives to extraction.[84]

58. The Inter-American Court of Human Rights, in its Advisory Opinion No. 32, underscored States' obligations to develop public policies on decent employment in the context of transition minerals; provide social protection, compensation and/or relocation for those negatively affected by mining; and measures to encourage and attract investment in innovation in low-emission activities. Its findings on the "reinforced" due diligence for States to cooperate and to adopt all necessary measures to transition towards sustainable development models that continuously enhance human well-being, thus protecting human rights and the environment, and on the jus cogens obligation to prevent irreversible harm to the climate system and the life-supporting systems on the planet, are equally crucial for decisions at all levels on energy transition minerals.[85]

V. Deep seabed mining

59. Given the multiple threats to ocean health and their implications for the climate system, combined with other planetary crises, a moratorium on deep-sea mining has

[79] Submission by Landesa and the International Land Coalition.

[80] See https://globalwitness.org/en/campaigns/transition-minerals/critical-mineral-mines-tied-to-111-violent-incidents-and-protests-on-average-a-year/.

[81] Kristi Disney Bruckner, "Improving environmental and social practices in the mining sector is essential in the transition to renewable energy", *Journal of Energy and Natural Resources Law*, vol. 41, No. 3 (2023).

[82] See www.eea.europa.eu/en/analysis/publications/improving-the-climate-impact-of.

[83] Submission by the Global Alliance on Incinerator Alternatives.

[84] See www.ohchr.org/en/statements/2024/09/all-action-critical-energy-transition-minerals-must-respect-human-rights-un.

[85] See www.ohchr.org/en/press-releases/2025/07/un-experts-hail-landmark-inter-american-court-opinion-states-extensive.

been supported by special procedure mandate holder from the perspective of international human rights law.[86] Should States members of the International Seabed Authority decide to prioritize the completion of the regulations on deep seabed mining, they should provide for a precautionary and participatory strategic assessment of potential risks for the environment, including the climate system, and for human rights, that is fully aligned with Advisory Opinion No. 31 of 2024 on climate change of the International Tribunal for the Law of the Sea (see A/HRC/56/46).

60. In addition, in accordance with articles 136, 154 and 160 of the United Nations Convention on the Law of the Sea, the Assembly of the International Seabed Authority should use its powers to:

(a) Launch an urgent, systemic review of the Authority's operations, to ensure that it is capable of fulfilling its mandate to protect the marine environment and advance marine scientific cooperation in accordance with Tribunal's Advisory Opinion No. 31;

(b) Adopt a general environmental policy aligned with Advisory Opinion No. 31;

(c) Create a subsidiary body to represent the common heritage of humankind, including representation of children, Indigenous Peoples and small-scale fishers, with a view to advancing the understanding of the Authority's impacts on human rights for present and future generations.

VI. Conclusions and recommendations

61. **The effects that climate change mitigation measures have on people and ecosystems must be carefully assessed through the full life cycle and through a human rights-based and ecosystem-based approach to ensure a just energy transition. This should be based on the equitable distribution of economic and environmental burdens, according to the Inter-American Court of Human Rights in its Advisory Opinion No. 32. Negative impacts on human rights and the environment can and should be prevented. The full protection and realization of human rights in the energy transition, through clear standards and mechanisms for participation and accountability, supports adaptive, inclusive and transformative governance, which leads, according to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, to new collaborations in creative learning processes that can reframe problems, navigate tensions, challenge established lock-ins and open new ways to overcome institutional path-dependency, thereby co-producing more holistic and effective climate solutions across a plurality of knowledge systems.**

62. **In order to manage energy demand and "defossilize" economies, States should, first and foremost, assess energy needs in the light of the rights to a healthy environment and to development and the need to prevent discrimination (see A/HRC/59/42). In particular, States should:**

(a) **Prioritize the needs of the most vulnerable;**

(b) **Reduce energy overproduction and overconsumption;**

(c) **Ensure progress in energy efficiency, considering that global energy efficiency experienced "sluggish progress" in recent years,[87] and prioritize**

[86] See www.ohchr.org/en/documents/policy-briefs/precautionary-principle-and-deep-seabed-mining-state-obligation-under.

[87] International Energy Agency and others, *Tracking SDG 7: The Energy Progress Report 2025* (Washington D.C., World Bank, 2025).

opportunities to make energy-efficient solutions more affordable to low-income households (see A/75/181/Rev.1);

(d) **Identify system-wide shifts towards more long-term and efficient sector-specific energy use reduction, applying "essential use" and circular economy approaches;**

(e) **Prioritize opportunities for renewables development at the nexus of climate, nature, water, food and health.**

63. **To ensure a coherent domestic legal framework for a human rights-based and ecosystem-based just energy transition, States should:**

(a) **Ensure that domestic laws on climate change, energy, nature, water, mining and human rights are aligned, requiring comprehensive human rights and environmental impact assessments for policies, plans and projects for renewables and transition minerals;**

(b) **Develop comprehensive domestic legislation on the protection of the rights of Indigenous Peoples, persons of African descent, peasants and small-scale fishers and of the right to a healthy environment, including children's right to a healthy environment, and clarify their applicability to renewables development and transition minerals;**

(c) **Establish mandatory human rights and environmental due diligence legislation in line with the Guiding Principles on Business and Human Rights, clarifying its applicability throughout the value chain of renewables and transition minerals.**

64. **With regard to assessing the full life cycle of renewables and related minerals, scientific literature points to the feasibility of 100 per cent global reliance on wind and solar energy, including leapfrogging opportunities for developing countries.[88] United Nations human rights experts have also suggested prioritizing wind and solar energy (see A/HRC/54/32/Add.1, A/HRC/55/43/Add.2 and A/HRC/60/30). Due to considerable climate, environmental and human rights concerns, new hydropower and bioenergy development should be considered with the highest level of precaution and extensive consideration of alternatives, in the context of a human rights-based and ecosystem approach, taking into account the need to protect and restore biodiversity as part of States' obligations related to climate change, as clarified by the International Tribunal for the Law of the Sea and the Inter-American Court of Human Rights in their respective advisory opinions. A precautionary approach should be applied to the consideration of geothermal and marine renewables, which can be most effective when planned for longevity and not narrowly focused on carbon sequestration.[89] States should therefore:**

(a) **Prioritize renewables that minimize environmental and human rights impacts through a life cycle assessment;**

(b) **Consider all possible alternatives to satisfy demand for secure renewable energy and all practicable steps to prevent or mitigate ecological harm;**

[88] Manish Ram and others, "Global energy transition to 100% renewables by 2050: not fiction, but much needed impetus for developing economies to leapfrog into a sustainable future", *Energy*, vol. 246 (1 May 2022).

[89] Pörtner and others, *IPBES-IPCC Co-sponsored Workshop: Biodiversity and Climate Change – Scientific Outcome*.

(c) **Ensure that biodiversity protection and restoration are integrated into strategic and project-level assessment, planning and development stages, including in site selection, project design and operational and monitoring practices, for renewables and energy transition minerals;**

(d) **Integrate land-marine spatial planning through participatory and inclusive approaches, in order to consider the cumulative impacts of renewables and energy transition minerals at the nexus and address conflicts of interest;**

(e) **Establish no-go zones in ecologically sensitive areas;**

(f) **Ensure participatory monitoring of the application of mitigation measures and of unforeseen negative impacts on the environment and on human rights.**

65. **According to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, to support the co-development of and fair benefit-sharing from the energy transition, nexus thinking should be embedded in participatory planning processes, so as to support collaborative methods for collecting and analysing data and develop a shared understanding of the natural, social, economic and political interactions related to the energy transition. Iterative and continuous learning about drivers and their interconnectedness is essential, particularly as these drivers, including technology, may change quickly over time.**

66. **A human rights-based participatory approach to the planning and implementation of renewables can thus support processes for evaluating, on the basis of the best available science, including Indigenous science and local knowledge, the impacts on climate mitigation, electricity generation, water supply, flood and drought management, irrigation, navigation, fisheries and recreational activities, as well as the economic benefits.**

67. **Fairly and equitably sharing the benefits of a just energy transition, as a requirement of the human right to science, Indigenous Peoples' human rights and peasants' human rights, entails moving away from a mere logic of exchange and "damage control". Instead, it requires collaboratively identifying and understanding opportunities for positive impacts, both locally and globally, according to Indigenous peoples', communities' and women's world views.**[90] **States are responsible for ensuring the genuine nature of consent in the context of customary institutions, with a view to providing the foundations for the emergence of a new resource governance model, premised on the notion of partnership.**[91] **Thus, States should put in place norms and practices to ensure that fair and equitable benefit-sharing supports community agency in the context of an iterative dialogue aimed at understanding different world views and realizing communities' choice and capabilities.**[92] **Both benefits protecting or enhancing communities' control over natural resources and benefits providing support for the exercise of effective control are needed. In addition, in the consideration of alternatives and of the justification for the final outcome, it is necessary to show how assessments differed from merely providing a pre-set**

[90] Elisa Morgera, *Fair and Equitable Benefit-sharing in International Law* (Oxford University Press, 2024).

[91] Victoria Tauli-Corpuz, "The concept of Indigenous Peoples' self-determined development or development with identity and culture: challenges and trajectories", paper commissioned by UNESCO, 2008.

[92] African Commission on Human and Peoples' Rights, *Centre for Minority Rights Development (Kenya) and Minority Rights Group International on behalf of Endorois Welfare Council v Kenya*, communication No. 276/2003, Judgment, 4 February 2010.

array of development options to communities. Any benefit must be measured against the broader context of historical and systemic injustices faced by communities. States should therefore:

(a) **Oversee consultations and their outcomes, in order to mitigate power imbalances between business entities and communities, including by guaranteeing access to independent technical and legal advice;**

(b) **Ensure that strategic environmental assessments and environmental impact assessments serve to identify, in an integrated fashion, the positive and negative impacts on the environment and on human rights of proposed renewables and related mining projects, in addition to any potential damage to ways of life, livelihoods, well-being and knowledge systems;**

(c) **Ensure that strategic environmental assessments and environmental impact assessments serve to genuinely support free, prior and informed consent and consultation processes, providing full, trustworthy and accessible information and consideration of benefit-sharing as early as the screening and scoping phases, including consideration of all alternatives and siting options, and integrating Indigenous and community methodologies;**

(d) **Require strategic environmental assessments and environmental impact assessments consultants to demonstrate sufficient understanding of Indigenous Peoples' science and other knowledge systems;**

(e) **Allow sufficient time for internal discussion within communities and create channels for sustained, effective and reliable dialogue with communities' representative institutions, supporting the realization of their right to decide their own development priorities;**[93]

(f) **Prevent misuse of benefit-sharing, such as when an economic advantage is offered in exchange for obtaining consent, when social cohesion of affected communities is undermined through bribes or selective negotiations tactics or when paternalistic mechanisms are not responsive to communities' needs;**

(g) **Support, in the first instance, community ownership or co-ownership and, where communities chose to engage with a business entity, require both community participation in decision-making and a share in profits and other benefits, such as high-skill employment and energy price reduction packages;**

(h) **Require compensation beyond market value for land acquisition, to ensure full livelihood restoration, ensuring that full compensation for resettlement is provided before landholders are required to vacate land;**

(i) **Verify that benefit-sharing agreements with business entities fully respect human rights.**

68. **Considering the track record of severe human rights violations and displacement among renewables megaprojects (see A/74/197) and the obligation to conduct strict due diligence to prevent transboundary environmental impacts and conflicts, States should support decentralized energy production, including as a form of climate change resilience. Extreme climate events can cripple large-scale energy infrastructure, whereas a more flexible nodal energy grid can**

[93] Ibid., paras. 212 and 289; and Inter-American Court of Human Rights, *Case of the Kichwa Indigenous People of Sarayaku v Ecuador*, Judgment (Merits and Reparations), 27 June 2012, paras. 165–177.

respond faster to outages and repairs, if local ownership and skills are supported. States should therefore:

(a) **Create enabling policies for decentralized renewables, particularly Indigenous-led, community-led and women-led projects;**

(b) **Adopt measures to reduce the cost of investments, such as the removal of import tariffs and indirect taxes on components for renewables technologies for domestic or community-level use;**

(c) **Target financial and technological resources for low-income households (see A/75/181/Rev.1), communities and women;**

(d) **Support the integration of decentralized renewables into the grid under equitable economic conditions.**

69. **To ensure efficiency, sustainability and responsibility in the life cycle of energy transition minerals, States should reduce the extraction and unsustainable consumption of minerals by:**

(a) **Prioritizing systemic shifts towards accessible electrified public transport, shared mobility systems and the integration of nature into cities to cool them;**

(b) **Introducing requirements and incentives for designing products for increased performance, longer lifespans and improved energy and resource efficiency and repairability;**

(c) **Not relying on mineral demand projections for policymaking and planning purposes, if those projections do not factor in recycling, reuse and technological developments and if they do not distinguish the use of minerals for the energy sector from that of other sectors, particularly those sectors that contribute significantly to climate change;**

(d) **Creating a regulatory environment for safely recovering minerals from end-of-life products, while preventing or addressing any reliance on fossil fuels in that connection.**

70. **With regard to ensuring responsible waste management and decommissioning, States should:**

(a) **Develop and enforce strict standards for recycling, repurposing and responsibly disposing of renewable energy equipment and infrastructure;**

(b) **Require companies, prior to commencing construction, to develop and make public fully costed waste management, remediation and decommissioning plans, including tailings storage safety guidelines [94] and recycling targets, coupled with independently verifiable financial assurances;**

(c) **Adopt laws on producer- or State-funded collection and responsible disposal of batteries and renewables materials.**

71. **States should prioritize research and research funding, especially for global North-South fair research partnerships and Indigenous-led, community-led and women-led research (see A/79/176), on:**

(a) **Human rights-based pathways towards reliance on solar and wind power;**

[94] See https://unece.org/environment-policy/publications/safety-guidelines-and-good-practices-tailings-management-facilities.

(b) **The environmental and human rights impacts of marine renewables, considering climate change and human rights impacts;**

(c) **Different approaches to ownership and partnerships in energy production, transmission and distribution in relation to Indigenous-led, community-led and women-led renewables;**

(d) **Low-carbon products and technologies that require fewer minerals and less energy, while minimizing human rights and environmental impacts;**

(e) **Human rights-based circular economies.**

72. **With regard to international cooperation, international public financial flows to developing countries in support of clean energy reached $21.6 billion in 2023, an increase of 27 per cent compared with 2022. However, the developing world received less in 2023 than in 2016 ($28.4 billion).**[95] **Africa possesses more than 60 per cent of the planet's solar energy potential, but receives only 2 per cent of worldwide renewables funding.**[96] **Developed States should create more fiscal space to support domestic value addition and economic diversification in developing countries.**

73. **Enhanced international cooperation and specific safeguards are needed to prevent neocolonial practices and the reinforcement of extractive models that benefit only the wealthier countries in terms of both energy and profits. For instance, 90 per cent of patents for renewable technologies are held by companies based in wealthy nations, resulting in high costs for companies located in developing countries.**[97] **To address this, the human right to science supports a shift from unidirectional transfers of technology towards a model based on the co-development of technologies, with a view to better responding to local needs, priorities and contexts, notably the needs of the vulnerable, and avoiding negative environmental and human rights impacts.**[98] **This could result in shared ownership of intellectual property and collaborative initiatives that support mutual learning, skills-sharing, local innovation and culturally relevant solutions, while preventing lock-in and dependency.**

74. **Developed States should provide grant-based finance, as well as debt relief and cooperation, to tackle tax avoidance and evasion (see A/HRC/58/51), to support developing countries in the following:**

(a) **Development and scaling up of renewables, notably through technology co-development in wind and solar power;**

(b) **Circular economy solutions that reduce new and current extraction, support reuse and challenge unsustainable energy demand;**

(c) **Enhancement of regulatory frameworks and institutional capacity to carry out life cycle assessments, inclusive planning and monitoring of renewables and transition minerals in accordance with a human rights-based and ecosystem-based approach;**

(d) **Support for Indigenous-led, community-led and women-led renewables projects.**

75. **States should cooperate to:**

[95] International Energy Agency and others, *Tracking SDG 7: The Energy Progress Report 2025*.
[96] Submission by the Migration Youth and Children Platform.
[97] Ibid.
[98] Morgera, *Fair and Equitable Benefit-sharing in International Law*.

(a) **Enhance global transparency and traceability of transition minerals, thus supporting the monitoring of human rights abuses;**

(b) **Harmonize regulation and capabilities for enhancing resource efficiency, reuse, recycling and repurposing;**

(c) **Create platforms for dialogue to share best practices and lessons learned, carry out joint assessments of Just Energy Transition Partnerships and other cooperation efforts and identify emerging and missed opportunities for transformative approaches at the nexus.**

76. **According to the Business and Human Rights Resource Centre, three quarters of top solar and wind project developers have human rights policies aligned with the Guiding Principles on Business and Human Rights, but few companies have adopted policies on Indigenous Peoples and land rights, and no company in the mining sector has adopted a robust policy on the protection of environmental human rights defenders. Companies that market solar panels or that are involved in building solar farms conduct traceability audits only occasionally.[99] According to a 2024 report by Amnesty International,[100] of 13 global electric vehicle makers studied, most did not demonstrate sufficiently that they were meeting international human rights standards.**

77. **With specific regard to renewables development and transition minerals in or near Indigenous territories, common business practices interpreting benefit-sharing as a charitable award or as a favour granted to secure social support for a project are not in line with international human rights standards (see A/HRC/15/37). Equally, benefit-sharing should not be used by companies to impose certain views of development upon Indigenous Peoples that could endanger their cultural or physical survival. Instead, if Indigenous Peoples themselves do not wish to initiate the projects themselves, companies should consider environmental impact assessments, free, prior and informed consent and benefit-sharing as a process for co-creating genuinely equal partnerships, whereby Indigenous Peoples both participate in project decision-making and share in their profits and other benefits (see A/66/288, A/HRC/21/47 and A/HRC/24/41). It is thus necessary to collaboratively identify benefit-sharing opportunities according to Indigenous Peoples' world views in the early stages of planning (see A/HRC/21/47) and incorporate agreed terms in contracts with reference to relevant international human rights standards and Indigenous Peoples' customary rules as principles of the interpretation of fairness and equity in benefit-sharing.**

78. **On the other hand, there are promising practices. At the 2025 Regional Forum for Latin American and the Caribbean on Business and Human Rights, companies reported on their efforts to consider the history of territories and a comprehensive contextual assessment of needs and potential impacts, before engaging with communities in meaningful dialogue. In a specific case in Taiwan Province of China, a Danish offshore wind power company engaged in understanding local fishing culture to prioritize early and continuous communication with local fishers on construction, operation and standardized safety practices. They recruited local fishers and supported them in obtaining certifications as environmental observers; created a fund to share profits for community livelihoods and fishery restoration; and shared wind and weather observational data with local research partners.[101]**

[99] Submission by Finnwatch.

[100] See www.amnestyusa.org/wp-content/uploads/2024/10/Recharge-for-Rights.pdf.

[101] See https://cdn.orsted.com/-/media/www/docs/corp/tw/en-chw-1-and-2a-case-study.pdf.

79. **Companies involved in renewables development, transition minerals and related supply and value chains should have robust human rights due diligence process, with a view to:**

(a) **Assessing land tenure, in addition to relying on formal or documented land rights, to identify all rights holders and baselines for environmental and human rights impact assessments, to estimate the direct and indirect area of influence of each project at the nexus;**

(b) **Providing funding for independent legal and technical experts to support Indigenous Peoples, persons of African descent and peasants in environmental impact assessments, consultations and benefit-sharing negotiations;**

(c) **Identifying benefit-sharing opportunities in the early stages of assessments and planning, with the meaningful participation of communities and according to community world views and history;**

(d) **Designing systems and products to enable maximum resource and energy efficiency and circularity through repair and reuse, and ensuring extended producer responsibility;**

(e) **Ensuring public access to information on contributions to circularity, on beneficial owners across the value chain, on the origin of minerals, and on contracts, licences, environmental and human rights impact studies, third-party audit findings and financial reports;**

(f) **Implementing "local content" provisions through meaningful job creation and the integration of local experts in management positions, including technological co-development;**

(g) **Supporting participatory long-term monitoring throughout the life cycle, including closure planning and environmental restoration;**

(h) **Establishing effective and accessible operational-level grievance mechanisms for workers and communities, in local languages and with powers to provide remedies, such as compensation and rehabilitation;**

(i) **Adopting enforceable zero-tolerance policies to prevent retaliation against environmental human rights defenders, including screening potential business partners for histories of retaliation.**

80. **Multilateral development banks and bilateral development finance institutions, which play a major role in renewables development (see additional materials III), should:**

(a) **Prioritize funding renewables projects at the nexus, particularly when they are Indigenous-led, community-led and women-led;**

(b) **Refrain from financing renewables projects that present high or unmitigated risks of environmental harm and human rights impacts;**

(c) **Expand the scope of their human rights safeguard policies throughout value chains;**[102]

(d) **Integrate learning from recommendations by independent redress mechanisms into their policies and decision-making;**

(e) **Make recommendations by independent redress mechanisms binding.**

[102] See www.ohchr.org/sites/default/files/documents/issues/development/dfi/ohchr-dfis-supply-chains-policy-brief-june-2025.pdf.

81. **Other recommendations:**

(a) **National human rights institutions should ensure that, in negotiations between developers and communities, respect for human rights is maintained and consultations with significant power and information asymmetries are mediated.**

(b) **The United Nations Development Programme, the United Nations Environment Programme and other implementing agencies of international climate finance projects should support States and business entities in implementing the recommendations of the present report.**