



Opportunity Green's submission to the Office of the High Commissioner for Human Rights' call for input on 'Technologies related to climate change and their impacts on human rights'

24 September 2026

[Opportunity Green](#) is an NGO tackling climate change using law, economics, and policy to motivate decision makers to achieve climate justice.

Opportunity Green welcomes the opportunity to respond to this call for input. We remain available for assistance and any further information; please contact Sapphire Ross: sapphire@opportunitygreen.org.

Introduction

Our submission covers shipping, aviation, heavy-duty vehicles (HDVs), and agriculture, which are significant sources of greenhouse gas (GHG) emissions and air pollution and have a growing range of climate related technologies intended to reduce emissions, but which can also have severe climate and human rights implications.

Together, these sectors account for a substantial share of global emissions: shipping and aviation contribute roughly 3%¹ and 2.5%² of global CO₂ emissions respectively; HDVs account for around 30% of on-road transport CO₂ emissions despite comprising only 3% of vehicles³; and Agriculture, Forestry, and other Land Uses (AFOLU) contributed an estimated 13–21% of global GHG emissions between 2010 and 2019⁴, while food systems as a whole accounted for approximately 34% of total global emissions in 2015⁵. These sectors are also significant sources

¹ International Maritime Organisation, 'Fourth Greenhouse Gas Study 2020', (2020), available at: <https://www.imo.org/en/ourwork/environment/pages/fourth-imo-greenhouse-gas-study-2020.aspx>

² Our World in Data, 'What share of global CO₂ emissions come from aviation?', (2024), available at: <https://ourworldindata.org/global-aviation-emissions>

³ Carbon Tracker, 'Heavy Duty Vehicles Decarbonisation: Hard-to-Abate?', (2024), available at: <https://carbontracker.org/heavy-duty-vehicles-decarbonisation-hard-to-abate/>

⁴ IPCC, 'Sixth Assessment Report to the IPCC Working Group III: Mitigation of Climate Change', (2023), Chapter 7 Agriculture, Forestry, and other Land Uses (AFOLU), available at: <https://www.ipcc.ch/report/ar6/wg3/chapter/chapter-7/>

⁵ Crippa, M., Solazzo, E., Guizzardi, D., Monforti-Ferrario, F., Tubiello, F.N. and Leip, A.J.N.F., 2021. Food systems are responsible for a third of global anthropogenic GHG emissions. *Nature food*, 2(3), pp.198-209.

of short-lived climate and air pollutants, including methane^{6,7}, nitrous oxide (N₂O)⁸, black carbon⁹¹⁰, nitrogen oxides (NO_x)¹¹, and particulate matter¹², which contribute to climate change, respiratory and cardiovascular disease, premature mortality, and other human health impacts.

As the International Court of Justice recognised in its Advisory Opinion on the Obligations of States in respect of Climate Change, a clean, healthy and sustainable environment is essential for the enjoyment of a number of human rights.¹³ Unabated emissions from these sectors alongside the technologies deployed to decarbonise them can themselves create human rights impacts that must be addressed to ensure a just and equitable transition (JET).

Many climate related technologies and so-called ‘transitional fuels’ across the sectors outlined in this submission risk further lock-in of fossil fuels for decades to come. It is therefore crucial to be alive to the significant climate and human rights impacts they pose and ensure that the full lifecycle impacts are considered.

Human rights concerns arising from climate-related technologies and fossil-fuel dependent ‘transitional fuels’

Shipping & aviation:

LNG is touted as a low carbon ‘transition fuel’ for international shipping, yet it typically contains 90% methane¹⁴, a gas over 80 times more potent than CO₂ over a 20-year period.¹⁵

In developing countries, LNG is often presented as a solution to energy poverty and economic development. However, 92% of LNG investment in countries such as Mozambique, Nigeria, and

⁶ Shipping’s methane emissions more than doubled between 2016 and 2023 due to increased use of LNG. International Council on Clean Transport, 2025, Greenhouse gas emissions and air pollution from global shipping, 2016–2023, available at: <https://theicct.org/publication/greenhouse-gas-emissions-and-air-pollution-from-global-shipping-2016-2023-apr25/>

⁷ Agriculture is responsible for 40% of global methane emissions. Climate and Clean Air Coalition and United Nations Environment Programme (UNEP), ‘Global methane assessment: benefits and costs of mitigating methane emissions’ (2021), online at: <https://www.ccacoalition.org/resources/global-methane-assessment-full-report> accessed 25 August 2026.

⁸ The majority of human-caused nitrous oxides emissions come from fertiliser use, a gas approximately 270 times more potent than CO₂ over a 100-year period. Global Carbon Project, ‘Global Nitrous Oxide Budget’ (2024), online at: <https://www.globalcarbonproject.org/nitrousoxidebudget/index.htm> accessed 25 August 2026.

⁹ International shipping produces substantial quantities of black carbon, a powerful short-lived climate pollutant over 1000 times more potent than CO₂ over a 20-year period. Mao X and others, ‘Greenhouse gas emissions and air pollution from global shipping, 2016–2023’ (2025) online at: <https://theicct.org/publication/greenhouse-gas-emissions-and-air-pollution-from-global-shipping-2016-2023-apr25/> accessed 24 August 2026.

¹⁰ Samset BH at al., ‘Climate effects of Black Carbon emissions: Updated GWP and GTP values after the IPCC AR6’ (2023) online at: <https://nva.sikt.no/registration/0198cc83c8ba-296f7f08-9f91-4685-a1ec-2ad67707409e> accessed 24 August 2026.

¹¹ Lohawala, N., Linn, J., Bioret, L., DeAngeli, E., Roy, N. and Spiller, E., ‘A retrospective analysis of heavy-duty vehicle tailpipe nitrogen oxides emissions standards’, (2025), *Transportation Research Part D: Transport and Environment*, 149, p.105065. Available at: <https://www.sciencedirect.com/science/article/pii/S1361920925004754>

¹² Particulate matter comes from many sources, including diesel- and gasoline powered vehicles, agriculture, and burning biomass for electricity. American Lung Association, State of the Air, 2026 Report, available at: <https://www.lung.org/getmedia/32f0646d-c5de-4501-b0ac-07cd63c974d4/State-of-the-Air-2026-Report.pdf>

¹³ Obligations of States in Respect of Climate Change (Advisory Opinion) [2025] International Court of Justice, paragraph 389.

¹⁴ Transport and Environment, 2022, Methane at Sea: Finding the Invisible Climate Killer, available at: <https://www.transportenvironment.org/articles/methane-finding-the-invisible>

¹⁵ Global Methane Pledge, The Imperative for Methane Action, available at: <https://www.globalmethanepledge.org/imperative-methane-action>

Tanzania is allocated to export terminals rather than domestic energy access,¹⁶ despite over 560 million people in Sub-Saharan Africa living without electricity.¹⁷

Across its lifecycle, LNG pollutes and degrades the environment affecting communities living near LNG facilities and ports. Air pollution remains the second leading risk factor for premature death in children and adults worldwide.¹⁸ In the United States, the world's largest LNG exporter, it is estimated that existing LNG export terminals alone will cause 2,020 premature deaths and \$28.7bn in health costs by 2050, with impacts disproportionately falling on Black and Latinx populations who most often live near LNG facilities. If all proposed and planned projects are built, Black Americans would experience air pollution from LNG terminals at 151% to 170% and Latino Americans 110% to 129% compared with the rate for white Americans.¹⁹

Biofuels also dominate the alternative shipping and aviation fuels market. The promotion of crop-based biofuels as a 'sustainable' option to fossil fuels can exacerbate food insecurity, as it is estimated that by 2034, 27% of global cereal production will be directed towards biofuels and industrial uses instead of food²⁰. Rising demand for crops such as corn for fuel production has already yielded increased market prices for those foods²¹, further preventing the most vulnerable from accessing adequate food.

Across shipping and aviation, the use of fossil fuels during alternative fuel production risks breaching States' legal obligations to reduce emissions. Alternative fuels including hydrogen, ammonia and methanol can be produced without relying on fossil fuels, however, production pathways using fossil fuels exist and can have higher lifecycle impacts than the fossil fuels they seek to replace.²² Even when coupled with Carbon Capture and Storage technology, achievable emissions reductions are vastly reduced compared to green fuel production pathways.^{23 24}

¹⁶ Holt, M, Risky Realities—Recognizing the Harms of Global LNG Expansion (2023), online at: <https://www.nrdc.org/bio/jamie-lee/risky-realities-recognizing-harms-global-lng-expansion>, accessed 16 September 2026.

¹⁷ World Health Organisation, '655 million people still living without electricity underscore urgent need to deliver on universal energy access target' (2026) *Joint News Release*, online at: <https://www.who.int/news/item/24-06-2026-655-million-people-still-living-without-electricity-underscore-urgent-need-to-deliver-on-universal-energy-access-target> accessed 16 September 2026.

¹⁸ Health Effects Institute, 'State of Global Air Report: A Report on Air Pollution and Its Role in the World's Leading Causes of Death' (2025) online at: <https://www.stateofglobalair.org/resources/report/state-global-air-report-2025#:~:text=world%20in%202023.-> accessed 16 September 2026.

¹⁹ Greenpeace & Sierra Club, 'Permit To kill: Potential health and economic impacts from U.S. LNG export terminal permitted emissions' *Greenpeace USA* (13 August 2024) available at: <https://www.greenpeace.org/usa/permit-to-kill/> accessed 16 September 2026.

²⁰ OECD-FAO, 2025, *Agricultural Outlook 2025-2034*, available at: https://www.oecd.org/en/publications/oecd-fao-agricultural-outlook-2025-2034_601276cd-en/full-report/cereals_251d1ece.html

²¹ Malode, S.J., Prabhu, K.K., Mascarenhas, R.J., Shetti, N.P. and Aminabhavi, T.M., 2021. Recent advances and viability in biofuel production. *Energy Conversion and Management*: X, 10, p.100070.

²² Chalaris I, Jeong B and Jang H, 'Application of Parametric Trend Life Cycle Assessment for Investigating the Carbon Footprint of Ammonia as Marine Fuel' (2022) 27 *The International Journal of Life Cycle Assessment* 1145 <https://doi.org/10.1007/s11367-022-02091-4>.

²³ Esquivel-Elizondo S et al., 'Climate Impact of Direct and Indirect N₂O Emissions from the Ammonia Marine Fuel Value Chain' (2025) 59(18) *Environmental Science & Technology* 9037-9048 <https://doi.org/10.1021/acs.est.4c13135>.

²⁴ Tomos BAD et al., 'Decarbonising International Shipping – A Life Cycle Perspective on Alternative Fuel Options' (2024) 299 *Energy Conversion and Management* 117848 <https://doi.org/10.1016/j.enconman.2023.117848>.

States should reject fossil fuel-dependent and crop-based fuels and instead prioritise genuinely sustainable fuel pathways that do not undermine equitable climate goals, human rights, health, food security, and the environment.

Heavy-Duty Vehicles (HDVs):

Hydrogen is increasingly presented by HDV manufacturers as a low-carbon alternative to diesel (with the strongest climate claims typically premised on the use of green hydrogen).²⁵ However, significant limitations remain to its viability as a HDV decarbonisation pathway consistent with human rights.

Global hydrogen production remains overwhelmingly fossil-fuel based: in 2025, hydrogen production generated around 1,000 MtCO₂, with natural gas accounting for roughly 60% of production.²⁶ Low-emissions hydrogen remained below 1% of global production.²⁷

Even assuming an adequate supply of hydrogen, its use in HDVs does not provide a credible transition pathway for meeting global climate targets while protecting human rights, for several reasons:

- Fossil-derived hydrogen risks further fossil-fuel lock-in, delaying the transition necessary to avert climate related human rights harms.
- Hydrogen combustion trucks retain downstream human rights harms from air pollution; they do not eliminate harmful emissions, and a shift towards hydrogen HDVs could result in 40% higher NOx emissions by 2050 than electrification.²⁸

Battery-electric HDVs ultimately provide the strongest pathway on both climate and human rights grounds. The International Council on Clean Transportation estimates substantial lifecycle GHG savings from battery-electric HDVs compared with diesel: 63–76% for vehicles entering service today when using average European Union (EU)-grid electricity, rising to 75–82% for vehicles entering service in 2030 as the grid decarbonises, and up to 92% when powered exclusively by renewable electricity.²⁹ Electrification also offers significant human rights co-benefits by reducing both GHG emissions and harmful air pollution. For instance, it is estimated that eliminating fossil-fuel combustion in 2017 would have reduced global PM_{2.5} exposure by 27.3%, prevented over one million premature deaths, and lowered rates of childhood asthma and premature birth.³⁰

²⁵ See, for example, [DAF](#) and [Volvo](#), which advertise hydrogen HDVs as capable of achieving net-zero CO₂ emissions on a well-to-wheel basis when using green hydrogen.

²⁶ International Energy Agency, 'Global Hydrogen Review' (2026) online at: <https://www.iea.org/reports/global-hydrogen-review-2026>, p. 83, accessed 16 September 2026.

²⁷ Ibid.

²⁸ Rebecca Drury et al., 'Breath of Fresh Air: The Risks of Air Pollution and the Opportunity Beyond Toxic Assets' (2026) ShareAction, online at: [Breath-of-fresh-air_investor-briefing_2026.pdf](#), p. 18, accessed 26 September 2026.

²⁹ Adrian O'Connell et al., 'A Comparison of the Life-Cycle Greenhouse Gas Emissions of European Heavy-Duty Vehicles and Fuels' (2023) International Council on Clean Transportation White Paper, online at: <https://theicct.org/wp-content/uploads/2023/02/lca-ghg-emissions-hdv-fuels-europe-feb23.pdf>, p.3, accessed 16 September 2026.

³⁰ Ibid, p. 18.

States should prioritise battery-electric HDVs to deliver emissions reductions while reducing air pollution and associated human rights impacts.

Agriculture:

On technology in agriculture many points are well covered in ‘A/HRC/62/44: Transforming food systems for a safe climate and health for all’³¹. In particular, fossil fuel expansion in food systems resulting in petro-chemical lock-in.

Conventional nitrogen fertilisers are highly fossil fuel dependent. Ammonia production through the energy-intensive Haber-Bosch process accounts for roughly 1% of global annual GHG emissions,³² whilst fertilisers contribute to an estimated 14-18% of agricultural emissions across their lifecycle (equivalent to roughly 5-6% of global GHG emissions).³³ Fertilisers are also a major source of nitrous oxide, while agricultural ammonia emissions contribute to the formation of PM_{2.5}. The severe climate and health consequences of these emissions and pollutants are outlined above and throughout this report.

Proposed technological transitions in fertiliser production also require scrutiny for the human rights and environmental implications, as electrification, carbon capture, and biomass-based pathways can entail significant land, water, and energy demands and therefore create new trade-offs^{34 35}. Technology assessments should therefore consider full lifecycle impacts, affordability, access, implications for smallholder farmers, and food security.

Additionally, the high methane emissions of the industrial livestock sector present multiple human rights concerns, including:³⁶

- impact on the agricultural industry itself and rural communities as weather patterns change and extreme weather events occur³⁷
- knock-on food security risks, particularly to vulnerable groups³⁸

³¹ United Nations General Assembly, Human Rights Council, A/HRC/62/44: Transforming food systems for a safe climate and health for all (29 April 2026), online at: <https://www.ohchr.org/en/documents/thematic-reports/ahrc6244-transforming-food-systems-safe-climate-and-health-all> accessed 16 September 2026.

³² Leigh Krietsch Boerner, ‘Industrial ammonia production emits more CO₂ than any other chemical-making reaction. Chemists want to change that’ (15 June 2019) *Chemical and Engineering News*, online at: <https://cen.acs.org/environment/green-chemistry/Industrial-ammonia-production-emits-CO2/97/i24> accessed 17 September 2026.

³³ Atul K. Jain, ‘Greenhouse gas emissions from nitrogen fertilizers’ (2023) *Nature Food*, online at: <https://www.nature.com/articles/s43016-023-00706-z> accessed 17 September 2026.

³⁴ Mingolla, S. and Rosa, L., ‘Low-carbon ammonia production is essential for resilient and sustainable agriculture’, (2025), *Nature Food*, 6(6), pp.610-621.

³⁵ Mingolla, S. and Rosa, L., ‘Low-carbon ammonia production is essential for resilient and sustainable agriculture’, (2025), *Nature Food*, 6(6), pp.610-621.

³⁶ UNEP, ‘Methane emissions are driving climate change. Here’s how to reduce them.’ *UNEP News, Stories & Speeches* (20 August 2021), online at: <https://www.unep.org/news-and-stories/story/methane-emissions-are-driving-climate-change-heres-how-reduce-them> accessed 25 August 2026.

³⁷ UNEP, ‘Sectoral Risk Briefings: Insights for Financial Institutions | Climate Risks in the Agriculture’ (2023), online at: <https://www.unepfi.org/wordpress/wp-content/uploads/2023/03/Agriculture-Sector-Risks-Briefing.pdf> accessed 25 August 2026.

³⁸ See Figure 1 in Alisher Mirzabaev et al., ‘Severe climate change risks to food security and nutrition’ (2023) 39 *Climate Risk Management*, online at: <https://www.sciencedirect.com/science/article/pii/S2212096322000808> accessed 25 August 2026.

- methane's role as a precursor to tropospheric ozone as a harmful air pollutant associated with reduced crop production and human health implications³⁹.

Utilisation of anaerobic digestion (AD) is increasing.⁴⁰ AD uses manure and other feedstocks to create biomethane. Whilst it can be a tool for reducing the need for fossil fuel-generated energy on farm and avoiding methane emissions from manure storage, there are risks in scaling it up,⁴¹ including:

- Incentivisation of intensive livestock production⁴² and / or land use change via commissioning and funding large AD plants that require high levels of feedstock, either from manure or energy crops (and the high cost of AD plants encouraging farm consolidation⁴³)
- Lock-in of gas infrastructure
- Lack of consistent regulation and monitoring to ensure emissions are minimised^{44,45}
- Failure to factor in the full lifecycle of AD emissions (e.g. land use change, production of other feedstocks beyond manure, storage and transport, methane loss during digestion, emissions from digestate remaining after AD process, refining of biogas to biomethane, further refining to produce LNG)⁴⁶
- Perpetuating the harms of LNG

Even with increased uptake of AD, livestock farming remains an emissions-intensive system perpetuating human rights issues. AD can uphold the status quo if treated as an 'offset',

³⁹ Climate and Clean Air Coalition and UNEP, 'Global methane assessment: benefits and costs of mitigating methane emissions' (2021) 18, online at: <https://www.ccacoalition.org/resources/global-methane-assessment-full-report> accessed 25 August 2026.

⁴⁰ International Energy Agency, 'Renewables 2025 – Analysis and forecasts to 2030' (2025), online at: <https://www.iea.org/reports/renewables-2025/biogases> accessed 25 August 2026.

⁴¹ Such scale up is likely. It is slated to play a bigger role in the EU energy mix going forward, for example: European Commission - Energy, 'Biomethane' (2026), online at: https://energy.ec.europa.eu/topics/renewable-energy/bioenergy/biomethane_en accessed 25 August 2026.

⁴² Recent studies done in California, USA and Denmark provide evidence to support this. See: Varun Magesh et al. 'Do methane mitigation incentives intensify livestock production? Evidence from California, 2016–2025' (2025) (Working paper) Stanford University & Johns Hopkins University, online at: <https://dho.stanford.edu/wp-content/uploads/digesters.pdf> accessed 25 August 2026; Foodrise & NOAH (Friends of the Earth Denmark), 'Denmark's dystopian dash for biogas: Driving intensive animal production, jeopardising the country's climate leadership' (2026), online at: <https://foodrise.eu/denmarks-dystopian-dash-for-biogas/> accessed 25 August 2026.

⁴³ Regarding affordability for small farms, see: Jakub Mazurkiewicz, 'The Impact of Manure Use for Energy Purposes on the Economic Balance of a Dairy Farm' (2023) 16(18) *Energies* 6735, <https://doi.org/10.3390/en16186735>.

⁴⁴ Clean Air Task Force, 'Strengthening the Environmental Benefits of Anaerobic Digestors' (2023), online at: <https://www.catf.us/wp-content/uploads/2026/05/Anaerobic-Digestors-Report.pdf> accessed 25 August 2026.

⁴⁵ Maria Olczak et al., 'Majority of methane emissions from European biogas plant supply chains could be eliminated at no net cost' (2026) 1(88) *Communications Sustainability*, online at: <https://doi.org/10.1038/s44458-026-00065-3>

⁴⁶ For example, under the EU Renewable Energy Directive (2023/2413) (RED III), manure is treated as a zero-emission feedstock. This means no upstream emissions, such as enteric fermentation, feed production and land-use change are factored in. RED III does not account for fugitive / operational methane emissions either – see analysis here: Dr Semra Bakkaloglu, 'Quantifying Methane Emissions in European Biogas Systems: A comparative supply chain analysis' (2025), online at: https://methanematters.eu/wp-content/uploads/2025/10/Report_-_Quantifying_methane_emissions_in_European_biogas_and_biomethane_supply_chains.pdf accessed 25 August 2026 and; Foodrise & NOAH (Friends of the Earth Denmark), 'Denmark's dystopian dash for biogas' (n48).

precluding absolute emissions reduction, particularly as most methane from livestock is from enteric fermentation, not manure storage.⁴⁷

States should assess agricultural technologies across their full lifecycle and favour solutions that reduce absolute emissions without undermining food security, livelihoods, land, water, and air quality.

Good practices and challenges in terms of human rights and environmental impact assessment of climate technologies

The human rights and environmental assessment of climate technologies should be holistic, accounting not only for emissions reductions but also impacts on the environment and safety concerns^{48 49}, assessments generally remain narrowly focused on GHG emissions.⁵⁰

In the shipping sector, ammonia has been proposed as an alternative fuel which could deliver substantial GHG emissions reductions compared to fossil fuels.⁵¹ This characteristic is captured by assessments which underpin decarbonisation policies in the EU and the International Maritime Organisation (IMO).

However, recent work has shown how poorly managed uptake of ammonia as a marine fuel risks widespread release of reactive nitrogen to the environment, at a scale which could substantially worsen current overshoot of the nitrogen Planetary Boundary. This could erode achievable GHG emissions reductions, as well as leading to negative air quality and environmental impacts, with potentially severe implications for coastal communities.^{52;53}

Holistic assessment, guided by the Planetary Boundaries framework, enables identification of the potential human rights and environmental impacts of using ammonia as a shipping fuel, as well as development of mitigating circumstances⁵⁴.

⁴⁷ Swati Hegde, Timothy D. Searchinger, and Mario Julien Diaz, 'Opportunities for methane mitigation in agriculture - Technological, economic, and regulatory considerations' (2025) *World Resources Institute*, online at: https://files.wri.org/d8/s3fs-public/2025-02/opportunities-methane-mitigation-agriculture.pdf?VersionId=WTCnlgnw7ktdUcbayS3Xl0pKHZ3s_BHF accessed 25 August 2026.

⁴⁸ Esquivel-Elizondo S et al., 'Ensuring the Climate and Environmental Integrity of Alternative Fuels' (2026) 60 *Environmental Science & Technology* 5219 <https://doi.org/10.1021/acs.est.5c07609>

⁴⁹ Esquivel-Elizondo S et al., 'Climate Impact of Direct and Indirect N₂O Emissions from the Ammonia Marine Fuel Value Chain' (2025) *Environmental Science & Technology* <https://doi.org/10.1021/acs.est.4c13135>.

⁵⁰ The Special Rapporteur on human rights and the environment has previously highlighted that mistakes have been made in seeking solutions for one issue (climate change) without considering the other (air pollution). See: David Boyd, 'Issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment' (Report of the Special Rapporteur, 8 January 2019), UN Doc A/HRC/40/55, para 43.

⁵¹ Esquivel-Elizondo S et al., 'Climate Impact of Direct and Indirect N₂O Emissions from the Ammonia Marine Fuel Value Chain' (2025) *Environmental Science & Technology* <https://doi.org/10.1021/acs.est.4c13135>.

⁵² Esquivel-Elizondo S et al., 'Ammonia Marine Fuel Can Reduce or Increase Reactive Nitrogen Pollution Depending on Emissions Controls' (2026) 1 *Communications Sustainability* 70 <https://doi.org/10.1038/s44458-026-00076-0>.

⁵³ Wong AYH et al., 'Climate and Air Quality Impact of Using Ammonia as an Alternative Shipping Fuel' (2024) 19 *Environmental Research Letters* 084002 <https://doi.org/10.1088/1748-9326/ad5d07>

⁵⁴ Steffen W et al., 'Planetary Boundaries: Guiding Human Development on a Changing Planet' (2015) 347 *Science* 1259855 <https://doi.org/10.1126/science.1259855>

Similar assessments must be applied to other climate technologies⁵⁵ sectors.^{56;57;58}

International human rights and due diligence obligations applicable to state and private actors in the context of climate-related technologies and transitional fuels

Under the customary duty to prevent significant harm to the climate system and environment, States must regulate the conduct of both public and private conduct taking place within their jurisdiction in order to avoid transboundary climate harm.⁵⁹ This is pertinent given the regulatory gap in the high-emitting industries discussed by this submission. Developments across various jurisdictions also are increasingly placing human rights and environmental obligations on corporate actors themselves, alongside states' own obligations.⁶⁰

Under the customary principle of international co-operation (which is also subject to a strict due diligence standard), states must provide financial assistance and technological support in light of achieving the temperature goal, and in line with best available science.⁶¹

To ensure a JET, developed states should provide sufficient, predictable, accessible, and equitable climate finance to developing states, reflecting their greater historical contribution to climate change and stronger financial and technological capacity. This is particularly important for Small-Island Developing States (SIDS) and Least Developed Countries (LDCs), which face disproportionate climate and human rights impacts despite having contributed little to global emissions and often having constrained fiscal and institutional capacity.

Climate finance should avoid increasing debt burdens or diverting resources from essential services such as food security, health and social protection⁶². Where climate measures impose additional costs or distributional impacts for developing countries, revenues should be equitably directed towards addressing those impacts.

The IMO Net-Zero Framework (NZF) provides an opportunity to embed these principles in shipping decarbonisation, as discussed in the following section.

States should strengthen regulation of high-emitting activities and provide predictable, accessible, and equitable finance and technology support to developing countries.

⁵⁶ Ryberg MW et al., 'Development of a Life-Cycle Impact Assessment Methodology Linked to the Planetary Boundaries Framework' (2018) 88 *Ecological Indicators* 250 <https://doi.org/10.1016/j.ecolind.2017.12.065>

⁵⁷ Steffen W et al., 'Planetary Boundaries: Guiding Human Development on a Changing Planet' (2015) 347 *Science* 1259855 <https://doi.org/10.1126/science.1259855>

⁵⁸ Esquivel-Elizondo S et al., 'Climate Impact of Direct and Indirect N₂O Emissions from the Ammonia Marine Fuel Value Chain' (2025) *Environmental Science & Technology* <https://doi.org/10.1021/acs.est.4c13135>.

⁵⁹ Obligations of States in Respect of Climate Change (Advisory Opinion) (2025) International Court of Justice, paragraph 282

⁶⁰ See, for example: *Milieudefensie v Royal Dutch Shell*; *Milieudefensie v ING Group*.

⁶¹ Ibid. paragraph 265

⁶² Opportunity Green, 'A Just and Equitable Transition in Shipping', (2025), available at: <https://opportunitygreen.org/climate-justice/reports/a-just-and-equitable-transition-for-shipping/>

Challenges and opportunities to defossilise our economies in the context of climate-related technologies, including international cooperation

Shipping:

The IMO NZF demonstrates how international cooperation can support the defossilisation of hard-to-abate sectors while addressing the human rights impacts of both climate change and the transition. The NZF combines a mandatory global fuel standard, requiring progressively lower GHG fuel intensity, with an economic mechanism that prices emissions⁶³. Through this mechanism, the Net-Zero Fund is expected to generate⁶⁴ annually to support a JET and to help mitigate disproportionate negative impacts of the transition on climate-vulnerable developing countries.

In line with broader climate finance principles, NZF revenues should support developing countries, particularly SIDS and LDCs, to reduce emissions and ensure that the costs and benefits of the transition do not exacerbate existing inequities. Member States should strive for equitable distribution that strengthens climate resilience, food security, capacity building, technology transfer, and investment in sustainable fuels and infrastructure, ensuring no one is left behind.⁶⁵

With formal adoption still pending, and amidst attempts to dismantle the economic backbone of the NZF, **Member States should internationally cooperate and strengthen the NZF's emissions trajectory, environmental safeguards, and revenue distribution arrangements, to ensure that shipping decarbonisation advances both climate and human rights objectives.**

HDVs:

Direct electrification presents the strongest opportunity to defossilise HDVs. Battery-electric trucks deliver the greatest lifecycle emissions reductions while improving energy efficiency and reducing primary-energy demand.⁶⁶ Commercial viability is also improving, as global electric truck sales grew nearly 80% in 2024, while commercial vehicle battery prices have fallen 30% since 2020 and total-cost-of-ownership parity is increasingly being reached.⁶⁷

Key barriers remain. High upfront costs disproportionately affect smaller hauliers, despite evidence that manufacturers have scope to reduce price premiums through more competitive pricing.⁶⁸ Electrification also requires substantial investment in charging infrastructure, grid connections and upgrades,⁶⁹ as well as stable, long-term regulatory frameworks and predictable

⁶³ International Maritime Organisation, 2025, IMO approves net-zero regulations for global shipping, available at: <https://www.imo.org/en/mediacentre/pressbriefings/pages/imo-approves-netzero-regulations.aspx>

⁶⁴ Transport and Environment, 2025, UN shipping agreement a victory for multilateralism but a failure for the climate, available at: <https://www.transportenvironment.org/articles/un-shipping-agreement-a-victory-for-multilateralism-but-a-failure-for-the-climate>

⁶⁵ Opportunity Green, 2025, IMO Net-Zero Framework: opportunities for ambitious action, available at: <https://opportunitygreen.org/shipping/briefings/imo-net-zero-framework/>

⁶⁶ Idle Giants, 'Behind the Curve: Why Legacy Truck Manufacturers Must Embrace High-Volume Electric Strategies to Stay Competitive' (2026) online at: <https://idlegiants.org/wp-content/uploads/2026/04/REPORT-Idle-Giants-Behind-the-Curve.pdf>, p. 4, accessed 16 September 2026.

⁶⁷ Ibid, p. 4.

⁶⁸ Ibid, p.3.

⁶⁹ Ibid, p.16.

vehicle demand to give manufacturers, utilities and charging providers confidence to invest.⁷⁰ Current efforts to weaken rules in major markets globally, including, HDV CO₂ standards in the EU and clean-truck regulations in the U.S.,⁷¹ risk undermining investment.

Given the significant climate and human rights harms associated with HDV emissions,⁷² (i) coherent and ambitious regulatory frameworks, including HDV-specific decarbonisation and air-quality plans, long-term CO₂ and pollutant emission standards, and fiscal measures such as emissions-differentiated road tolls; (ii) equitable finance for vehicle purchases and enabling infrastructure, including predictable funding cycles, point-of-sale incentives and targeted support for SMEs and smaller fleet operators. Crucially, these measures should support electrification globally rather than concentrating deployment in wealthier markets; and (iii) investment in charging and grid infrastructure to enable deployment at scale while ensuring electric trucks remain accessible to smaller operators.

States should accelerate global electrification through ambitious, predictable regulation, targeted financial support and investment in infrastructure, prioritising smaller operators and developing markets.

⁷⁰ Ibid, p. 16.

⁷¹ Ibid, p. 17. See also Matilda Graham, 'Truck manufacturers' US climate legal intervention creates legal risks' (2026) online at: <https://opportunitygreen.org/climate-law/insights/truck-manufacturers-us-climate-legal-intervention-legal-risks/>, noting that the Truck and Engine Manufacturers Association (whose members include Volvo Group, Daimler Truck and Traton) sought to intervene in litigation supporting the repeal of the EPA's Endangerment Finding, which underpins federal GHG emissions regulation, an intervention in tension with their stated climate commitments and with the regulatory certainty needed to support the zero-emission transition.

⁷² Matilda Graham and Laurent Sammouri, 'Loaded: The Legal Risks of Air Pollution Caused by Heavy-Duty Vehicles' (Opportunity Green, July 2026), online at: [Loaded-the-legal-risks-of-air-pollution-caused-by-Heavy-Goods-Vehicles-June-2026-1.pdf](#), accessed 16 September, p. 2.