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Protection of Public Health and Environmental Safety through Effective Global Regulatory Governance of Decarbonisation

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Abstract

Decarbonisation must be implemented globally because it is essential for environmental protection and public health in the 21st century. Existing governmental regulations operate in a fragmented manner because they lack both strict enforcement mechanisms and distributional justice principles needed for sustainable operations. This research investigates how international governance systems function to maintain human health while implementing systematic decarbonisation processes. The research team used doctrinal research methods together with systematic literature reviews, which analyzed academic studies and policy documents from 2014 to 2025 to discover essential implementation deficiencies which exist between different regions. The results show that most policies focus on achieving environmental objectives while neglecting to address social equity issues and financial risk assessment. The review establishes that sustainable decarbonisation requires comprehensive regulatory systems that operate across sectors and require better coordination between institutions to achieve energy transitions that are both durable and equitable. These governance systems must be developed because they are the primary means of enabling climate objectives to protect the environment.

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1. Introduction

Human carbon emissions, which result from human activities, directly contribute to climate change, which poses severe risks to ecosystems and human health. These emissions, which mainly result from burning fossil fuels, lead to more frequent and intense extreme weather events, including floods, wildfires, and droughts (Anani et al.,

2022; Bino & Aidonojie, 2025). These hazards cause two types of damage: direct physical harm and indirect impacts, including heat stress, malnutrition, and the spread of vector-borne infectious diseases. Carbon-related air pollutants create poor environmental conditions that lead to millions of early deaths each year from respiratory and cardiovascular diseases (Braga & Pinto Jr., 2024). Environmental shocks in this area widen social disparity because they disproportionately affect disadvantaged groups living in resource-limited areas. The cumulative effects of emissions will undo 50 years of advances in global health and development (Obuseh et al., 2025; Oberthür et al., 2021). The current impacts require immediate action because they will create future economic losses that will become too large to control amid upcoming humanitarian emergencies. Recognising health-climate connections is essential because it supports the creation of safety systems that require all parties to work together (Hough & Cohen Tanugi-Carresse, 2024). Implementing effective climate solutions has become essential for our survival.

Decarbonisation is an essential solution that protects environmental safety while improving public health worldwide. Societies can achieve substantial reductions in greenhouse gas emissions by shifting from fossil fuels to renewable energy sources such as solar and wind power. This transition produces major health advantages, including better air quality and fewer cases of chronic illnesses such as asthma and stroke (Ukhurebor et al., 2024; Yeyeng & Aidonojie, 2024). The implementation of low-carbon technologies must occur in all sectors, from power generation to transportation and healthcare services, to achieve the Paris Agreement goal of maintaining the 1.5°C global warming limit (Hermwille, 2021; Kirk et al., 2021). Decarbonisation builds economic resilience by reducing energy costs and advancing environmentally friendly technologies. The program improves social determinants of health by reducing energy poverty and providing underserved communities with access to dependable clean energy (Peng & Ou, 2022; Rusdiana et al., 2025). The comprehensive decarbonisation plan protects Earth systems, which safeguard essential water and food resources for future generations. The most effective way to build a healthy and fair future for all humans is to achieve carbon neutrality.

The existing international legal framework for environmental protection has significant deficiencies that prevent successful implementation of decarbonization efforts and health protection measures (Aidonojie et al., 2024; Zhong & Hodgson, 2022). The Paris Agreement sets high targets through its main treaties, but these goals depend on voluntary commitments that lack mandatory enforcement. The existing legal framework creates problems because it divides regulations across multiple jurisdictions and sectors, resulting in different policies and compliance difficulties (Zhang & Zhao, 2023; Dong et al., 2022). Existing regulatory systems give excessive attention to environmental goals while failing to address important aspects of social justice and financial risk assessment. Fossil fuel industry interests cause delays, reducing the effectiveness of developing and enforcing strong environmental protection measures (Leal-Arcas et al., 2019; Aidonojie, 2023). The absence of common standards for emissions and health impact evaluation hinders the ability to evaluate the success of regulatory measures. Environmental treaties lack practical implementation because their enforcement currently depends on a global enforcement organisation that does not exist.

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Environmental degradation continues at an alarming rate because policy implementation does not match the design of environmental protection policies (Dbouk et al., 2025; Wang & Zhang, 2023). There is an urgent need to strengthen international governance systems to enforce decarbonization regulations at all levels.

The original research topic adds value through its combined approach, linking planetary health principles with international decarbonisation control systems (Peng et al., 2024; Leal-Arcas et al., 2022). The study develops a comprehensive safety assessment method by examining multiple sectors, including healthcare and energy and industrial operations, rather than studying single technological or economic components. The research shows that the "Health in All Policies" framework serves as a powerful instrument which helps organizations establish public health as their central priority during energy conversion processes (Hamid et al., 2022; Al Amosh & Khatib, 2025). The study shows how environmental protection and human rights interact, while ethical leadership drives climate action. The study establishes a framework which compares environmental responsibilities between developed and developing countries to solve the North-South environmental responsibility gap (Rockström et al., 2017; Chiang et al., 2024). The research examines how artificial intelligence and blockchain technology can transform regulatory supervision and responsibility enforcement. This approach advances the discussion by establishing health as the primary factor shaping international environmental policies (Mirow et al., 2024; Penttinen, 2022). The research offers an innovative path for establishing a socially equitable, low-carbon economy that supports community resilience.

The primary objective of this study is to critically evaluate the effectiveness of global regulatory governance in facilitating a sustainable energy transition while protecting public health (Wang et al., 2024; Alamoush et al., 2023). The study examines which structural barriers prevent international policy commitments from producing real environmental and safety outcomes. The study specifically examines how institutional mechanisms, such as carbon pricing and green procurement, can be optimised to incentivise large-scale decarbonisation. The research also aims to evaluate how multi-level governance systems help align local health requirements with international climate objectives. The research seeks to develop a unified compliance framework that establishes common global standards for near-zero emission materials and technologies. The study will examine regional case studies to produce practical recommendations which will help organizations build their institutional capacity and improve their stakeholder participation. The research aims to establish a strong evidence base to support global governance reforms that protect environmental justice and maintain public safety over time.

2. Method

This research utilizes a doctrinal method of study, which analyzes primary and secondary legal materials through systematic review techniques. The primary sources include international treaties, national legislation, and regulatory directives, such as the Paris Agreement, the Clean Air Act, and EU climate laws, obtained from official government and intergovernmental databases. The researchers retrieved secondary materials, which consisted of peer-reviewed journals and expert policy reports from 2014 to 2025, through academic databases like Scopus

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and Web of Science, and Google Scholar, using structured keywords related to decarbonisation and public health. The researchers selected these materials according to predefined inclusion criteria, ensuring the study included regional and sectoral perspectives across both energy-intensive industries and the healthcare sector. The research method enables researchers to assess how legal principles function within existing policy frameworks.

The analysis uses a multidimensional framework to assess how different socioeconomic conditions create variations in policy implementation effectiveness and policy coherence across various policies. The study evaluates governance capacity through two types of policy impacts, which include short-term impacts and long-term impacts, while using standardised measures of institutional effectiveness and rule of law. The analysis uses comparative research and inductive reasoning to identify barriers stemming from financial risks and insufficient accountability that prevent the development of integrated regulatory governance best practices. The study uses data from multiple fields, such as medicine, law, and engineering, to identify new governance approaches that address current environmental pollution problems. The systematic evaluation process establishes evidence-based findings that provide a strong foundation for developing policy recommendations that improve global climate initiatives. The analysis shows that adaptive governance systems need new methods to manage the growing challenges posed by climate-related health emergencies.

3. Results and Discussion

3.1. Adverse Effects of Carbon Emissions on the Environment and Public Health Safety

Human activities produce carbon emissions which create the current greenhouse effect by establishing a "net positive energy balance" which traps heat in Earth's atmosphere (Wang et al., 2024; Alamoush et al., 2023). Since the start of the Industrial Revolution, greenhouse gas (GHG) emissions have increased rapidly, with atmospheric CO2 levels reaching 400 parts per million (ppm) for the first time throughout human history. The accumulation of these gases has raised global temperatures by about 1.0°C above pre-industrial levels, with projections indicating that temperatures will reach 1.5°C by 2030. The oceans are the main physical consequence because they have absorbed 90% of the extra energy, which results in rising surface temperatures and the yearly loss of 159 billion tonnes of Antarctic ice (Anani et al., 2023; Ibokette et al., 2024). Current environmental changes exceed theoretical projections because they disrupt Earth's ecosystems, which provide essential support for human existence. As temperatures continue to rise, the probability of reaching permanent tipping points will grow, resulting in a break in human advancement over time (Bataille et al., 2016; Wang et al., 2024). Carbon emissions create a chain reaction that leads to environmental destruction, jeopardising the security and equilibrium of worldwide ecosystems.

The greenhouse effect has become more intense because of human activities, which lead to multiple climate hazards that cause more frequent and severe floods, wildfires, droughts and intense storms. These extreme weather events cause immediate destruction to human infrastructure and create social unrest. Urban land cover will triple by 2030, meaning more people will face these hazards (Ali, 2024; Aidonojie et al., 2024b). The Intergovernmental Panel on Climate Change (IPCC) reports that storms and floods cause direct damage, resulting in physical harm and creating climate refugees who leave their home communities. These events create physical dangers and disrupt food and water supplies, resulting in widespread

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malnutrition and contamination of vital resources (Gallagher & Holloway, 2020). The environmental damage includes extensive biodiversity loss and ecosystem destruction, which decrease the planet's ability to sequester carbon naturally. The interaction of these hazards produces complex crises that are harder for human institutions to control, particularly in regions that lack resources and have limited capacity for adaptation.

Direct exposure to rising temperatures and heatwaves creates an urgent health risk for outdoor workers and older adults, who are vulnerable groups (Lah, 2017; Gao et al., 2023). The upcoming climate change and urbanization population growth patterns will create new health risks from heat, according to model predictions. The 2015 Lancet Commission declares that heat stress directly causes increased deaths from cardiovascular and respiratory conditions, while people experience a major decline in their ability to perform physical tasks. The 2003 European heatwave demonstrated its danger through documented "excess mortality" during the event (Zhou et al., 2025; Wang et al., 2023). Projections show that dangerous extreme heat conditions will affect more people as the population grows and more people move to crowded urban areas. Extreme heat combined with social factors creates worse mental health conditions, together with post-traumatic stress disorder symptoms (Quitzow et al., 2025; Bumpus & Liverman, 2008). Rising temperatures will create health problems that will exceed public health system capacity and reverse all the progress made in international health and development over the last 20 years.

The combination of carbon-intensive activities and poor ambient air quality leads to multiple deaths worldwide, totalling several million every year. The World Health Organization (WHO) has published trustworthy reports which show that poor air quality results in approximately 7 million deaths worldwide each year, with 30,000 of those deaths happening in the United Kingdom. Carbon emissions often occur alongside dangerous pollutants, including sulfur dioxide (SO2), nitrogen oxides (NOx), and fine particulate matter (PM2.5) that enters the lungs (Ávalos Rodríguez et al., 2022). The pollutants lead to the direct development of lung cancer, acute respiratory infections and stroke and cardiorespiratory diseases. The electricity sector in the United States contributes to 10% to 15% of the annual 100000 to 200000 deaths caused by air pollution. People who live near industrial ports or heavily trafficked areas face greater health risks because of two critical factors: population density and population demographics (Triantoro et al., 2026). The climate-health connection shows that fossil fuel combustion creates hazardous environments that continuously produce hidden dangers to public health.

Based on the details provided in the conceptual clarifications regarding the adverse effects of carbon emissions, the following table summarizes the key facts, environmental impacts, and public health consequences:

Adverse Effects of Carbon Emissions on the Environment and Public Health

Category	Key Facts and Figures	Environmental Consequences	Public Health Consequences
Greenhouse Effect & Atmospheric Change	CO2 levels surpass 400 ppm for the first time in human history. Global average temperatures have	Oceans have absorbed 90% of excess energy, causing rising surface temperatures and the loss of 159 billion	Disrupts the stability of planetary systems necessary to sustain human life; risks reaching irreversible tipping points.

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	risen 1.0°C above pre-industrial levels.	tonnes of Antarctic ice annually.	
Cumulative Climate Hazards	Projections suggest reaching 1.5°C warming between 2030 and 2052. Urban land cover is projected to triple by 2030.	Floods, wildfires, droughts, and intense storms are projected to become more frequent and severe. Significant biodiversity loss and ecosystem collapse.	Leads to physical injury, malnutrition, and the displacement of entire communities, creating climate refugees.
Heatwaves & Thermal Stress	The return Period of extreme heat events is significantly shortening. Vulnerable populations include the elderly, outdoor workers, and children.	Heat interacts with social dynamics, exacerbating urban heat islands.	Cardiovascular and respiratory mortality; significant reduction in physical work capacity. Exacerbates mental ill-health and post-traumatic stress.
Ambient Air Quality Degradation	Linked to approximately 7 million premature deaths globally every year. In the US, electricity emissions cause 10%–15% of air-pollution deaths.	Co-emitted pollutants include PM2.5, SO2, and NOx. Poor air quality is most acute near industrial ports and high-traffic areas.	Causes lung cancer, acute respiratory infections, stroke, and cardiorespiratory diseases. PM2.5 penetrates deep into the respiratory system, causing immediate and long-term harm

Sources: Alamoush et al., 2023; Wei and Ou, 2022; Nick et al., 2015

Carbon emissions create negative impacts which lead to environmental changes that help infectious diseases to spread. The distribution of disease vectors such as mosquitoes, which transmit malaria and dengue fever, will shift because of increased temperatures and changing precipitation patterns (Watts et al., 2015). The WHO reported that climate change impacts which scientists fully understand will result in 250000 extra deaths each year between 2030 and 2050. Climate conditions now support increased vector reproduction in regions where temperature used to restrict their growth, which will result in more malaria cases that already claim 660000 lives annually (Li et al., 2025). Flooding worsens water-borne diseases such as cholera by disrupting access to clean drinking water. The social processes that shape these indirect mechanisms create resource conflicts that drive mass migration, putting additional pressure on public health systems (Valtsis & Chrysanthopoulou, 2025). The interconnected nature of these risks explains how carbon emissions lead to environmental damage, which

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disrupts both biological systems and human social structures that protect global public health safety.

3.2. Decarbonisation as a Panacea to Environmental Protection and Public Health Safety

Decarbonisation refers to the permanent elimination of fossil carbon emissions through the development of renewable energy sources that can replace carbon-based fuels. The world needs to make this shift to help industrial and social activities meet the Paris Agreement target, which permits only a 1.5°C global temperature increase (Thombs et al., 2025; Lange & Cummins, 2021). Societies need to achieve "net zero" by 2050 through two primary methods: reducing emissions and sequestering carbon to address remaining emissions after mitigation efforts. This approach protects the environment by limiting carbon dioxide emissions, the main driver of global warming. Successfully implementing decarbonisation policies requires major changes in how energy is produced, how people travel, and how industries operate to prevent major climate disasters (Nisiforou et al., 2022; Sovacool et al., 2024). The decarbonisation process establishes an emissions-reduction path that helps maintain ecosystem health while protecting the planet's long-term environmental stability. This approach is the most effective way to separate economic development from environmental harm, creating sustainable development for every country (Finn et al., 2024).

Decarbonisation produces immediate effects that function as a universal solution because it improves air quality and protects human health. Decarbonisation aims to eliminate CO2 emissions, which occur alongside short-lived air pollutants during fuel combustion. Renewable energy sources enable societies to achieve substantial reductions in PM2.5, SO2, and NOx emissions, which represent primary causes of respiratory and cardiovascular diseases (Pearson et al., 2023; Visscher et al., 2016). The 2015 Lancet Commission states that tackling climate change through emissions reduction could be the "greatest global health opportunity of the 21st century". The immediate benefits of reducing pollutants include fewer asthma cases, fewer lung cancer cases, and fewer premature deaths. The modelling results show that China can achieve a 50 per cent reduction in air pollution-related life expectancy loss by 2050 through climate mitigation strategy implementation (Anderson & Gough, 2021; Zhang & Dong, 2023). This system's clean-air solutions show that decarbonisation serves as both an environmental objective and a healthcare strategy to protect human lives and reduce healthcare costs.

Decarbonisation relies on renewable energy implementation, which establishes two essential benefits of environmental protection and health equity (Vadi, 2015; Sovacool et al., 2020). Low- and middle-income countries (LMICs) have made significant progress in expanding access to wind, solar, and hydropower, which now deliver dependable electricity to communities and essential health facilities. Social well-being depends on reliable energy because the WHO found that only 33% of hospitals in some African countries maintained reliable electricity systems, which obstructed their ability to respond during emergencies (Ismail et al., 2025). Clean energy sources eliminate indoor air contamination from diesel generators and kerosene, and decarbonisation is making clean energy available to developing countries. Renewable energy technologies are currently reducing costs, creating a "no-regret" solution that eliminates fuel poverty and strengthens economic resilience. Strategic investments in green energy infrastructure development ensure that disadvantaged communities participate in the global energy transition (Hough & Cohen Tanugi-Carresse, 2024). Decarbonisation provides

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essential energy resources for modern healthcare delivery systems and for maintaining healthy living conditions, which increases global health equity.

Decarbonising both the transportation and industrial sectors offers distinct opportunities to improve public health through fundamental transformations of existing systems. In developed countries, road transport accounts for 25 per cent of total greenhouse gas emissions, and electrification is the main way to decarbonise (Obuseh et al., 2025; Oberthür et al., 2021). The transition from fossil-fueled vehicles to electric vehicles (EVs) that run on a decarbonised grid removes harmful tailpipe emissions. Urban planning needs to implement active transport systems which support walking and cycling as the primary approach to achieve decarbonisation goals (Ukhurebor et al., 2024; Yeyeng & Aidonojie, 2024). Implementing these activities benefits cities by reducing pollution levels and creating more opportunities for people to exercise, which lowers the risk of cardiovascular disease, diabetes, and certain cancers. Decarbonising energy-intensive industries (EIIs), including steel and cement production, requires implementing innovative technologies such as green hydrogen, which prevents local ecosystems from experiencing heavy metal pollution (Aidonojie et al., 2024; Zhong & Hodgson, 2022). These shifts create a built environment that provides a healthier space to promote active living throughout the community.

The healthcare sector must demonstrate proper decarbonisation leadership because its mission includes producing no harm to patients. Healthcare facilities currently contribute nearly 5% of global GHG emissions, driven largely by supply chain operations, which account for more than 70% of their total emissions (Scope 3). The "Global Road Map for Health Care Decarbonisation" enables health systems to achieve their climate footprint reduction goals through operational changes that will result in a 45 gigaton decrease in CO2e by 2050. Hospitals need to power their operations with 100% renewable electricity, build zero-emissions facilities, and promote environmentally friendly medication solutions (Peng & Ou, 2022; Rusdiana et al., 2025). Hospitals that implement energy-saving programs generate substantial cost reductions, which they use to enhance patient care systems. Climate-smart healthcare systems develop facility and community resilience, which provides organizations with better preparedness against upcoming pandemics and climate-related emergencies (Leal-Arcas et al., 2019; Aidonojie, 2023). When the sector dedicated to healing takes action, it provides a powerful leadership signal that accelerates broader societal transformation toward a zero-emissions future.

The UN Sustainable Development Goals (SDGs) exist because decarbonisation is the main way to connect environmental conservation with human development. Successful energy transitions help achieve three specific goals: Goal 3 (Good Health and Well-being), Goal 7 (Affordable and Clean Energy), and Goal 13 (Climate Action). Through its decarbonisation efforts, the organisation sets a climate limit below 2°C, safeguarding against catastrophic outcomes, including water shortages, agricultural failures, and sea-level rise (Dbouk et al., 2025; Wang & Zhang, 2023), that threaten the global community's existence. The program promotes a One Health approach, showing how human health depends on both other living beings and the shared environment. Credible institutions show that complete solutions require both technical and financial support, and they require strong political commitment to overcome opposition from the fossil fuel industry (Zhang & Zhao, 2023; Dong et al., 2022). When countries develop their national policies according to deep decarbonisation pathways, they create a combined effect which helps to protect the environment and public safety as both

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goals work together (Peng et al., 2024; Leal-Arcas et al., 2022). The only way to safeguard health determinants in the 21st century is for societies to implement complete decarbonisation.

3.3. Legal Framework on Decarbonisation for Environmental and Public Health Safety

Several core international legal instruments are comprehensively represented in the diagrammatic flow below (Rockström et al., 2017; Chiang et al., 2024). However, only a few core global laws on decarbonization for environmental and public health protection will be examined below.



The United Nations Framework Convention on Climate Change (UNFCCC) establishes the essential legal framework for climate change mitigation efforts which simultaneously protect public health. The 1992 treaty establishes that climate change, along with its negative impacts, represents a "common concern of humankind" (Hermwille, 2021; Kirk et al., 2021). The Convention's Article 1.1 defines adverse effects as changes that produce harmful outcomes for ecosystems, socioeconomic systems, and human health and welfare. The treaty assessment shows that states possess a sovereign right to use their resources, yet the treaty requires them to protect their territory from environmental harm which would affect neighboring countries (Mirow et al., 2024; Penttinen, 2022). Article 2 requires countries to maintain greenhouse gas levels within safe thresholds that prevent "dangerous anthropogenic interference with the climate system". The framework maintains "common but differentiated responsibilities" as its core principle because it acknowledges developed countries' historical responsibility for emissions and requires them to lead climate action (Hamid et al., 2022; Al Amosh & Khatib, 2025). The legal system creates two different responsibilities because global decarbonization has become an essential safety requirement, yet each country must implement it according to its own development needs.

The Kyoto Protocol marks the first major extension of this framework, establishing mandatory emission reduction targets through legally binding agreements. Article 3 requires Annex I Parties to control their total carbon dioxide equivalent emissions so they remain below their designated emission limits (Wang et al., 2024; Alamoush et al., 2023). Unlike its general statements, the Protocol requires specific decarbonization procedures that will result in better environmental protection. The measures involve improving energy efficiency, safeguarding greenhouse gas sinks (including forests), and developing renewable energy sources through

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research. Article 2(1)(a)(v) establishes market imperfections as a problem which requires the elimination of financial incentives and support programs that currently exist in greenhouse gas-emitting industries (Bataille et al., 2016; Wang et al., 2024). The regulatory change serves public health needs because the law uses waste-management methane recovery processes to reduce transport emissions, which result in pollution-related diseases. The Protocol establishes a precedent which treats decarbonization as an essential industrial and agricultural transformation that enables sustainable development for future generations (Ukhurebor & Aidonojie, 2021).

The Paris Agreement established a legal framework that shifted to an inclusive process built on "Nationally Determined Contributions" (NDCs), rather than mandatory requirements from higher authorities. Under Article 2, the global average temperature increase must remain below 2°C, with a goal of 1.5°C, to prevent dangerous climate change impacts. Article 4 requires Parties to achieve "global peaking of greenhouse gas emissions as soon as possible" while reaching an equilibrium between emission sources and carbon sinks during the latter part of the current century. The legal instrument uses the "right to health" as its principal guideline for taking actions which combat climate change across all activities (Ali, 2024; Aidonojie et al., 2024). The Agreement establishes a legal ratchet system for decarbonization that requires Parties to submit new NDCs demonstrating "progression" and their "highest possible ambition". The framework establishes "climate justice" requirements which protect public health through its provisions while mandating that vulnerable groups, including children and persons with disabilities who suffer most from carbon-intensive development, must receive protection.

The International Health Regulations (IHR 2005) provide the legal mechanism for managing the public health emergencies that decarbonization aims to prevent. The IHR is a treaty that protects public health through its Article 2 function of preventing and controlling disease outbreaks. Climate change, driven by carbon emissions, creates more frequent heatwaves and droughts while increasing the spread of food-borne and zoonotic diseases (Anani et al., 2023; Ibokette et al., 2024). The IHR requires States Parties to establish essential capabilities to conduct surveillance and response to identify extraordinary public health situations. IHR Annex 5 establishes specific measures to address vector-borne diseases that may increase in geographical spread due to changing weather patterns (Ávalos Rodríguez et al., 2022). The legal requirement to inform the World Health Organisation (WHO) about events that might create a "public health emergency of international concern" establishes an international protection system that safeguards against health threats resulting from environmental destruction. The IHR serves as the legal framework for responding to environmental health threats that require active protection through decarbonization efforts established under the UNFCCC and the Paris Agreement.

The WHO Global Strategy on Health, Environment and Climate Change provides a transformation framework that connects environmental legislation with public health regulations (Zhou et al., 2025; Wang et al., 2023). The study demonstrates that health system sustainability is threatened when organizations do not address the primary factors which lead to health conditions. The evaluation of Strategic Objective 2 shows that it supports "Health in All Policies", which requires all decarbonization processes within energy, transport, and urban development to establish "good health" as their main goal. The Strategy states that existing governance systems fail to address problems which require multi-dimensional solutions (Lah,

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2017; Gao et al., 2023). The system recommends public safety measures through primary prevention methods which combat environmental factors responsible for 13 million annual deaths from preventable environmental dangers. The legal structure for decarbonization methods establishes a primary framework for disease prevention that extends beyond its role as a climate mitigation approach.

The process of analyzing these laws through critical synthesis shows how global economic systems interact with public health safety. The UNFCCC and its subsequent instruments recognize that response measures to climate change can have social and economic impacts, particularly on developing countries (Quitzow et al., 2025; Bumpus & Liverman, 2008). Article 9 of the Paris Agreement requires developed nations to provide financial resources to assist developing nations with both mitigation and adaptation, with a current goal of mobilizing USD 100 billion per year. A critical gap remains: worldwide healthcare expenditure reaches 10 per cent of global GDP, yet far less funding goes to primary interventions that prevent environmental hazards. The legal framework must move beyond setting targets and focus on the "shaping of research and driving innovation" to close knowledge gaps concerning microplastics, electronic waste, and endocrine-disrupting chemicals. The health sector must assume its leadership position in "stewardship, leadership and coordination" if decarbonization wants to protect public health through a "socially-just transition" to a low-carbon future.

3.4. Challenges in Global Regulatory Governance of Decarbonisation

Global governance of decarbonization faces fundamental obstacles because national sovereignty rights conflict with obligations to prevent environmental damage that crosses international borders (Pearson et al., 2023; Visscher et al., 2016). The principle of "Common but Differentiated Responsibilities" creates additional challenges for regulatory equity by delaying environmental protection efforts to prioritise development needs. The existing governance system operates in fragmented silos, preventing health considerations from entering non-health areas, while non-punitive transparency systems create major accountability gaps that hinder progress toward international safety standards (Valtsis & Chrysanthopoulou, 2025). These are therefore represented in a diagram and examined in detail:



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International environmental protection obligations clash with national sovereignty rights, creating the main legal obstacle to global decarbonization governance. The UNFCCC establishes that while States have the "sovereign right to exploit their own resources," they simultaneously bear the "responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States". The regulatory framework creates complex conditions which treat decarbonization as a "common concern of humankind" because of its global importance (Nisiforou et al., 2022; Sovacool et al., 2024). Stabilising greenhouse gas emissions requires implementation within a Period that permits "economic development to proceed sustainably". The legal problem emerges when domestic economic priorities clash with the international goal of atmospheric stabilization. Current governance often fails to bridge this gap because environmental legislation usually addresses specific local needs instead of the critical worldwide health emergency (Thombs et al., 2025; Lange & Cummins, 2021). The sovereignty-based approach makes it difficult for countries to implement global public health standards because they view external environmental requirements as unjustified financial burdens. The global regulatory system continues to function as a collection of voluntary agreements rather than a comprehensive environmental safety framework with mandatory regulations (Anderson & Gough, 2021; Zhang & Dong, 2023).

The second important legal matter concerns how "Common but Differentiated Responsibilities" (CBDR) creates unequal treatment among different regulatory systems. The UNFCCC, together with the Paris Agreement, requires developed nations to lead climate change efforts because of their historical emissions (Gallagher & Holloway, 2020). The legal system establishes dual standards that demand "highest possible ambition" from all parties, while implementation depends on "respective capabilities" and individual national conditions. This distinction creates difficulties for public health protection because it allows developing countries to achieve their "global peaking of greenhouse gas emissions" target more slowly (Vadi, 2015; Sovacool et al., 2020). The system acknowledges developing countries' "legitimate priority needs" to achieve "poverty eradication", but it also creates a legal requirement that prevents immediate action to protect human health from "adverse effects" that require mitigation. Developed nations face ongoing regulatory challenges because they must meet their legal duty to deliver "new and additional financial resources" together with "transfer of technology" to other countries (Braga & Pinto Jr., 2024). Developing nations need these mandated resources to establish "core capacities" that protect environmental health; without them, their communities face danger from rising climate-sensitive diseases.

The legal separation of environmental regulations and public health regulations creates significant obstacles for effective governance (Triantoro et al., 2026). The International Health Regulations (IHR 2005) aim to "prevent, protect against, control, and provide a public health response to the international spread of disease", yet they operate independently of climate treaties such as the Kyoto Protocol and the Paris Agreement. Existing governance systems cannot address environmental health issues that require integrated solutions because of their current "siloed" structure (Watts et al., 2015; Li et al., 2025). Energy and transport policies continue to be established without acknowledging their impact on "attainment and protection of good health". The WHO Global Strategy recommends "Health in All Policies" (HiAP), which establishes a legal requirement to assess the health effects of decisions made outside the health sector. The absence of a legally binding framework which combines health co-benefits

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with climate mitigation methods creates a "lost opportunity" to achieve all the advantages of a low-carbon economy (Finn et al., 2024; Ismail et al., 2025). Establishing a "common vision" that connects the "right to health" with urban and industrial development requires legal frameworks to achieve social cohesion.

Implementing international decarbonization law faces challenges because it requires mechanisms to ensure compliance and maintain transparency. The Kyoto Protocol required Annex I Parties to fulfil their emission-reduction obligations through legally binding targets, which they had to meet using precise measurement standards (Hamid et al., 2022; Al Amosh & Khatib, 2025). The Paris Agreement established an approach that enables countries to develop their Nationally Determined Contributions, which are recorded in a public registry, while using an enhanced transparency framework for reporting requirements instead of enforcement mechanisms. The facilitative system establishes a legal committee that operates through non-adversarial, non-punitive processes. The system encourages participation, but it creates major problems because States need to meet their emission targets, which protect public health (Wang et al., 2024; Alamoush et al., 2023). The legal framework establishes requirements which need to be followed for reporting purposes, but it does not enforce specific outcome-based targets. This shift creates a governance gap that prevents NDCs from achieving their temperature goals because they will not meet the 1.5°C limit needed to prevent dangerous anthropogenic interference, which harms ecosystems and human health (Ukhurebor & Aidonojie, 2021). Creating a low-carbon future requires strong enforcement because the current system relies on mutual trust and confidence rather than enforcement of legal requirements.

The financial jurisprudence of "Just Transition" creates a complex legal obstacle to global regulatory oversight. The Paris Agreement requires developed countries to mobilise "USD 100 billion per year" to support developing nations. The legal framework defining "climate finance", along with its distribution methods for safeguarding public health, remains under negotiation (Bataille et al., 2016; Wang et al., 2024). The current distribution of the healthcare budget shows major governance failings because it allocates only limited funds to "primary prevention" activities that address environmental risks. The pricing system omits the total costs of doing nothing, shifting expenses onto the healthcare system and society (Anani et al., 2023; Ibokette et al., 2024). The legal system requires organizations to remove all "harmful subsidies" while they must redirect their spending toward environmentally sustainable options. The "right to development" needs legal resolution through which it can exist together with "socially-just transition" requirements, which will safeguard at-risk groups, including children, migrants, and people with disabilities, from disease "upstream determinants" (Zhou et al., 2025; Wang et al., 2023). Future governance needs to create legal frameworks that require financial systems to support "climate-resilient development" pathways that protect human health over industrial operations.

4. Conclusion

Worldwide regulatory systems for decarbonization that control environmental emissions create an essential link between international environmental legislation and the universal human right to health protection. The United Nations Framework Convention on Climate Change, together with the Paris Agreement, shows that climate mitigation has become a primary means of protecting public health. The existing governance system faces barriers because national

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sovereignty conflicts with international obligations that must be fulfilled. The "common concern of humankind" establishes a legal framework for action, yet the "Common but Differentiated Responsibilities" principle delays disaster response, putting vulnerable groups at risk from growing environmental threats. Existing legal systems, including the Kyoto Protocol's binding commitments and the Paris Agreement's transparency measures, have not achieved atmospheric stabilisation because they fail to protect public safety. Successful decarbonization governance relies on a solution that combines economic development with essential primary prevention measures to protect present and future generations.

States need to implement a Health in All Policies (HiAP) system that makes public health co-benefits the primary focus when making decarbonization choices for the energy, transportation, and agricultural industries. The existing legal system needs to shift from its current sector-based governance model to an integrated model that lets the health sector assume its role as the main driver of cross-sector coordination and management. The current climate action financial system needs adjustment because healthcare expenditures consume 10 percent of global GDP, yet primary prevention receives almost no funding. International legal instruments should require climate finance to support upstream disease determinants by funding clean fuel implementation and eliminating financial backing for greenhouse gas-emitting industries. The International Health Regulations 2005 should strengthen their connection with climate treaties to establish a comprehensive environmental emergency monitoring and response system. The Paris Agreement needs to strengthen its transparency system to ensure Nationally Determined Contributions meet the 1.5°C target and protect environmental safety and global health rights.

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Conflict of Interest

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