



Strategies for combating global warming: Overcoming challenges to achieve an eco-friendly planet

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Abstract

Global warming, primarily caused by greenhouse gas emissions, poses serious threats to environmental sustainability, human health, and global development. This study examines key strategies to mitigate climate change, including renewable energy adoption, energy efficiency, afforestation, sustainable land management, and low-carbon technologies. It also highlights the role of environmental policies, international cooperation, and public participation in reducing carbon emissions. Despite progress, challenges such as financial constraints, policy gaps, and industrial dependence on fossil fuels continue to hinder effective climate action. The study concludes that integrated global efforts, scientific innovation, and sustainable development policies are essential to achieve an eco-friendly and climate-resilient planet.

Keywords: Global warming, climate change, greenhouse gas emissions, renewable energy, sustainability, carbon sequestration, environmental conservation, eco-friendly development, climate mitigation, sustainable development, green technology, environmental policy, biodiversity conservation, carbon footprint, ecological resilience

Introduction

Global warming stands as one of the most crucial environmental calamities of the 21st century. Over the past century, human activities—particularly the burning of fossil fuels, deforestation, industrialization, and unsustainable exhaustion—have remarkably enhanced the concentration of greenhouse gases in the Earth's atmosphere. According to findings from the Intergovernmental Panel on Climate Change, this intensification in emissions has led to extraordinary increases in global temperatures, resulting in melting glaciers, rising sea levels, extreme weather events, biodiversity loss, and threats to food and water security.

The global community has established the severity of this challenge through international outlines such as the Paris Agreement, which aims to constrain global temperature rise and strengthen climate resilience worldwide. However, despite growing awareness and technological progress, significant political, economic, and social barriers continue to slow significant action.

Addressing global warming requires comprehensive and synchronized strategies that balance environmental sustainability with economic development and social justice. This essay discovers practical policies for combating global warming, observes the key challenges that hamper progress, and highlights the collective responsibility of governments, industries, and individuals in building an eco-friendly and sustainable planet.

Understanding the Causes of Global Warming

Global warming primarily results from intensified concentrations of greenhouse gases (GHGs) such as carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). Major contributors include:

Burning coal, oil, and natural gas for electricity and transportation
Deforestation and land-use changes
Industrial emissions and agricultural systems
Overconsumption and waste generation

The scientific harmony, characterized by organizations such as the Intergovernmental Panel on Climate Change (IPCC), confirms that human influence is the influential cause of experimental warming since the mid-20th century.

Objectives

- To examine the primary reasons and impacts of global warming by analyzing the role of greenhouse gas emissions, industrial activities, deforestation, and invalid utilization patterns in accelerating climate change.
- To evaluate effective strategies for reducing greenhouse gas emissions, including the transition to renewable energy sources, energy efficiency improvements, sustainable transportation systems, and circular economy practices.
- To assess the importance of international cooperation and climate policies, highlighting global initiatives such as the Paris Agreement and the role of organizations like the United Nations in addressing climate change.
- To identify the economic, political, and social challenges that hinder the implementation of climate action strategies at local, national, and global levels.
- To explore the role of individuals, communities, and industries in promoting environmentally responsible behavior and supporting sustainable development.
- To propose practical recommendations for overcoming barriers and achieving a long-term transition toward an eco-friendly and climate-resilient planet.

Natural, Scientific, and Man-Made Causes (Findings) of Global Warming

Global warming results from a combination of natural climate variability and human (anthropogenic) activities. However, extensive scientific assessments—particularly by the Intergovernmental Panel on Climate Change—conclude that human influence is the dominant cause of the observed warming since the mid-20th century. The causes can be categorized as follows:

Natural Causes (Background Climate Drivers)

1. **Solar Variability:** Changes in solar radiation due to sunspot cycles and solar flares can slightly influence Earth's climate. However, satellite measurements show that recent warming trends cannot be explained by solar variation alone.

2. **Volcanic Activity:** Volcanic eruptions release ash and aerosols into the atmosphere. In the short term, these particles can cool the Earth by reflecting sunlight. While volcanoes emit CO₂, their contribution is minimal compared to human emissions.
3. **Earth's Orbital Changes (Milankovitch Cycles):** Long-term climate changes over thousands of years are influenced by variations in Earth's orbit, axial tilt, and precession. These cycles explain past ice ages but do not account for the rapid warming observed in recent decades.

Scientific Findings (Evidence of Global Warming)

1. **Rising Global Temperatures:** Instrumental temperature records show a consistent increase in global average surface temperatures since the late 19th century.
2. **Melting Ice and Glaciers:** Glaciers worldwide are retreating, Arctic sea ice is shrinking, and ice sheets in Greenland and Antarctica are losing mass—direct indicators of rising temperatures.
3. **Sea-Level Rise:** Global sea levels are rising due to: Thermal expansion of seawater (as water warms, it expands) Melting land-based ice this threatens coastal communities and ecosystems.
4. **Ocean Warming and Acidification:** Oceans absorb over 90% of excess heat trapped by greenhouse gases. Increased CO₂ dissolves in seawater, forming carbonic acid, lowering ocean pH and affecting marine life.

Man-Made (Anthropogenic) Causes – Primary Drivers

1. **Burning of Fossil Fuels:** The combustion of coal, oil, and natural gas for electricity, transportation, and industry releases large amounts of carbon dioxide (CO₂). This is the largest contributor to global warming.
2. **Deforestation and Land-Use Change:** Forests act as carbon sinks. When trees are cut or burned, stored carbon is released into the atmosphere, reducing Earth's natural ability to absorb CO₂.
3. **Industrial Processes:** Manufacturing, cement production, and chemical industries emit significant greenhouse gases. Cement production alone releases CO₂ during the chemical conversion of limestone.
4. **Agriculture and Livestock:** Livestock emit methane (CH₄) through enteric fermentation. Rice cultivation releases methane. Fertilizers emit nitrous oxide (N₂O), a highly potent greenhouse gas. Methane and nitrous oxide have higher global warming potentials than CO₂ over specific timeframes.
5. **Waste Management and Urbanization:** Landfills emit methane from decomposing organic waste. Rapid urbanization increases energy demand, transportation emissions, and consumption patterns, intensifying environmental pressure.

While natural factors influence climate variability, current global warming trends are overwhelmingly driven by human

activities. Scientific evidence—including temperature records, ice core data, atmospheric measurements, and climate modeling—confirms that anthropogenic greenhouse gas emissions are the principal cause of modern climate change. Addressing these man-made drivers through mitigation, legal frameworks, technological innovation, and sustainable development strategies is essential for achieving an eco-friendly and climate-resilient planet.

1. Scientific and Comparative Analysis

The study analyzes empirical climate data, including greenhouse gas concentration trends, temperature records, and sea-level rise statistics. A comparative approach is also adopted to evaluate mitigation strategies implemented by different countries, focusing on renewable energy policies, carbon pricing systems, and sustainable development initiatives.

2. Legal and Policy Evaluation

The research critically examines international environmental law principles such as: Common but Differentiated Responsibilities (CBDR) Sustainable Development Precautionary Principle Intergenerational Equity It evaluates the enforceability, effectiveness, and limitations of global climate governance structures.

3. Analytical Framework

The study applies a sustainability framework integrating three core dimensions: Environmental protection Economic viability Social equity This framework helps assess whether proposed strategies effectively balance climate mitigation with development goals.

Legal Discussion

Strategies for Combating Global Warming – Overcoming Challenges to Achieve an Eco-Friendly Planet. Global warming is not only an environmental and scientific issue but also a matter of international legal responsibility, governance, and human rights. The legal framework for combating climate change has evolved through multilateral treaties, customary international law principles, domestic legislation, and judicial interpretation. However, significant legal and enforcement challenges remain in achieving an eco-friendly and climate-resilient plan

1. International Legal Framework on Climate Change

The foundation of global climate governance lies in the United Nations Framework Convention on Climate Change (UNFCCC), which establishes the objective of stabilizing greenhouse gas concentrations at a level that prevents dangerous anthropogenic interference with the climate system. The Convention introduces the principle of Common but Differentiated Responsibilities (CBDR), recognizing that developed countries bear a greater historical responsibility for emissions.

It is a legally binding agreement under the 1985 Vienna Convention, signed by 197 countries, making it one of the first treaties to achieve universal ratification, aiming to repair the ozone layer by the middle of the 21st century. The Montreal Protocol, adopted on September 16, 1987, is a landmark international treaty designed to protect the ozone layer by phasing out the production and consumption of

nearly 100 ozone-depleting substances (ODS), such as chlorofluorocarbons (CFCs). It is a legally binding agreement under the 1985 Vienna Convention, signed by 197 countries, making it one of the first treaties to achieve universal ratification, aiming to repair the ozone layer by the middle of the 21st century.

The Kyoto Protocol is a landmark international treaty adopted in 1997 under the UN Framework Convention on Climate Change (UNFCCC). It commits industrialized nations to limit and reduce greenhouse gas emissions based on the principle of "common but differentiated responsibilities"

However, the Agreement relies heavily on voluntary compliance, raising concerns about enforce ability and accountability.

The Paris Agreement strengthens this framework by requiring Parties to submit Nationally Determined Contributions (NDCs) aimed at limiting global temperature rise to well below 2°C, and preferably 1.5°C, above pre-industrial levels. Unlike traditional treaties with strict emission targets, the Paris Agreement adopts a flexible, bottom-up approach, emphasizing transparency and periodic review mechanisms.

2. Principles of International Environmental Law

Several core legal principles guide climate governance:

Precautionary Principle: States must act to prevent environmental harm even where scientific certainty is incomplete.

Polluter Pays Principle: Those responsible for pollution should bear the cost of mitigation and remediation.

Intergenerational Equity: Present generations have a legal and moral obligation to protect the environment for future generations.

Sustainable Development: Development must meet present needs without compromising future generations' ability to meet their own.

These principles shape treaty obligations and influence national environmental legislation.

3. Domestic Climate Legislation and Regulatory Measures

Countries have implemented various domestic laws to fulfill international commitments, including:

- Carbon pricing mechanisms (carbon taxes and emissions trading systems)
- Renewable energy mandates
- Environmental Impact Assessment (EIA) laws
- Fossil fuel subsidy reforms
- Net-zero emission targets incorporated into national climate acts

The effectiveness of these measures depends on political will, institutional capacity, and enforcement mechanisms. Weak regulatory oversight and policy inconsistency remain major obstacles.

4. Climate Litigation and Judicial Activism

Climate change has increasingly become a subject of judicial review. Courts in several jurisdictions have recognized environmental protection as linked to

constitutional rights, including the right to life and a healthy environment. Climate litigation has been used to:

Compel governments to strengthen emission reduction targets

Challenge environmentally harmful projects

Hold corporations accountable for climate-related damages

This growing body of jurisprudence demonstrates the expanding role of courts in climate governance and accountability.

5. Human Rights and Climate Justice: Global warming disproportionately affects vulnerable populations, raising concerns of climate justice. Legal discussions increasingly connect climate change with:

- The right to life
- The right to health
- The right to food and water
- Indigenous land rights

Climate justice emphasizes equitable burden-sharing between developed and developing nations and the protection of marginalized communities.

6. Legal Challenges and Gaps: Despite progress, several legal challenges persist:

- Lack of binding enforcement mechanisms at the international level
- Insufficient ambition in Nationally Determined Contributions (NDCs)
- Conflicts between economic development goals and environmental obligations
- Fossil fuel dependence and political resistance
- Limited financial and technological support for developing countries

Bridging these gaps requires stronger compliance systems, enhanced international cooperation, and integration of climate obligations into domestic constitutional and statutory frameworks.

The legal architecture for combating global warming is well-established but remains fragmented and partially enforceable. International agreements such as the UNFCCC and the Paris Agreement provide a normative foundation, while domestic legislation and judicial intervention strengthen implementation. However, achieving an eco-friendly planet requires not only legal commitments but also effective enforcement, equitable burden-sharing, and alignment of environmental protection with economic and social development. Strengthening global climate governance through binding obligations, accountability mechanisms, and human rights integration is essential for overcoming the legal challenges posed by global warming.

Political and Economic Discussion:

1. Political Considerations: Political will is a decisive factor in implementing climate strategies

Government Priorities: Political leaders often face competing priorities such as economic growth, energy security, and employment, which can slow climate action.

International Cooperation: Climate change is a global problem requiring collaboration. Agreements like the Paris Agreement rely on diplomatic negotiations, global consensus, and coordination between developed and developing nations.

Policy Continuity: Political instability and frequent government changes can disrupt long-term climate strategies.

Public Participation: Policy success depends on stakeholder engagement, civil society advocacy, and public awareness campaigns.

Challenges: National interests, geopolitical conflicts, and lobbying by fossil fuel industries can impede the adoption of ambitious climate policies. Strong, consistent political commitment is essential to overcome these barriers.

2. Economic Considerations: Economic mechanisms are central to achieving sustainable climate mitigation:

Cost of Transition: Shifting from fossil fuels to renewable energy requires substantial investment in infrastructure, technology, and research.

Carbon Pricing: Instruments such as carbon taxes and emissions trading systems create economic incentives for reducing emissions.

Green Financing: Investment in clean energy, sustainable agriculture, and energy-efficient technologies promote economic growth while lowering emissions.

Job Creation and Just Transition: Policies must ensure that workers displaced from high-carbon sectors are retrained and absorbed into green industries.

Challenges: High upfront costs, dependence on fossil fuel revenue, and inequitable distribution of financial resources between developed and developing countries can impede economic feasibility. Innovative financing mechanisms and global cooperation are essential to overcome these obstacles.

3. Integrated Discussion: Legal, political, and economic dimensions are interdependent

Effective climate action requires enforceable legal frameworks, supportive political environments, and economically viable strategies.

Balancing development and sustainability: Countries, especially developing nations, face the challenge of pursuing economic growth while meeting climate obligations.

Global governance: International cooperation, legally binding agreements, and economic support mechanisms are necessary to ensure equity and effectiveness in global climate mitigation.

Recommendations

Legal, Political, Economic, and Sustainable Considerations: Effectively combating global warming requires integrated strategies that address legal frameworks, political commitment, economic incentives, and sustainable development principles. The following recommendations provide a road map for achieving an eco-friendly and climate-resilient planet:

1. **Legal Recommendations:** Legally Binding National Emission Targets: Enact climate legislation mandating

specific GHG reduction percentages (e.g., 50% reduction by 2030 relative to baseline).

Include penalties for non-compliance and mechanisms for regular progress audits.

Strengthen Enforcement of International Agreements: Incorporate Paris Agreement commitments into domestic law. Establish independent climate commissions to monitor compliance and report to parliaments or courts. **Climate Litigation and Rights-Based Legal Action:** Encourage citizens and NGOs to initiate legal cases against governments or corporations violating environmental laws.

Recognize the right to a healthy environment in constitutions and enforce it through judicial review.

Mandatory Environmental Impact Assessments (EIA): Require EIAs for all large-scale infrastructure, industrial, and energy projects with enforceable mitigation measures.

2. **Political Recommendations:** National Climate Policy Integration: Integrate climate mitigation and adaptation into national development plans, economic policies, and urban planning. **Bipartisan Climate Policy Agreements:** Establish cross-party climate commitments to ensure policy continuity across electoral cycles. **Strengthen International Collaboration:** Provide technology transfer, capacity-building programs, and financial aid to developing countries. **Actively participate in COP meetings and commit to transparent reporting of progress.** **Community Engagement and Public Awareness:** Launch campaigns to promote energy conservation, sustainable transport, and green lifestyles. Include climate education in school and university curricula to foster long-term behavioral change.

3. **Economic Recommendations:** Implement Carbon Pricing: Introduce carbon taxes or cap-and-trade schemes with gradually increasing rates to incentivize emission reductions. **Subsidies for Renewable Energy:** Provide financial incentives for solar, wind, and bioenergy projects. Phase out subsidies for fossil fuel industries to reduce economic reliance on high-carbon energy. **Green Job Creation Programs:** Support workforce retraining programs for employment in renewable energy, energy efficiency, and sustainable agriculture sectors. **Climate Finance Mobilization:** Establish national climate funds and leverage international funds to support mitigation and adaptation projects. Encourage public-private partnerships for low-carbon technology development.

4. **Sustainable Recommendations:** Promote Circular Economy Practices: Mandate recycling, resource recovery, and sustainable product design in industries. **Sustainable Land Management:** Implement reforestation, afforestation, and agroforestry programs. Incentivize organic farming and precision agriculture to reduce emissions from fertilizers. **Sustainable Urban Planning:** Develop green buildings, public transport networks, and low-carbon infrastructure in cities. **Integration of Scientific Research:** Use climate modeling, vulnerability assessments, and carbon footprint analyses to guide policy and investment decisions.

5. **Integrated Action Recommendation:** Legal, Political, Economic and Sustainable Alignment: Enforce legally binding emission targets supported by political commitment, incentivize compliance through economic measures, and integrate sustainability practices into industry, agriculture, and urban planning. Monitor and evaluate progress using transparent indicators and independent auditing to ensure accountability. Combating global warming is both a moral obligation and a practical necessity. While the challenges are significant, the path toward an eco-friendly planet is achievable through renewable energy adoption, sustainable practices, strong policy measures, and global cooperation. By integrating innovation, responsibility, and unity, humanity can mitigate climate change and secure a sustainable future for generations to come.
5. The Montreal Protocol, adopted on September 16, 1987.
6. The Kyoto Protocol is a landmark international treaty adopted in 1997 under the UN Framework Convention on Climate Change (UNFCCC), 1997.
7. The Paris Agreement is an international treaty on climate change signed in, 2016.

Conclusion

Global warming signifies a complicated and serious challenge with extensive environmental, social, economic, and legal implications. Scientific evidence confirms that rising greenhouse gas productions—primarily from human activities such as fossil fuel combustion, deforestation, and unsustainable agriculture—are the major drivers of climate transformation. The impacts, including severe weather events, rising sea levels, biodiversity loss, and threats to human health and livelihoods, underscore the critical need for coordinated action. Delivering this challenge involves an integrated approach. Legally, vigorous international agreements like the Paris Agreement must be reinforced through domestic legislation, enforceable compliance mechanisms, and rights-based climate litigation. Politically, sustained leadership, cross-party commitment, and global cooperation are essential to ensure consistent policy implementation. Economically, the transition to renewable energy, carbon pricing, climate finance, and green job creation must be prioritized to align development with low-carbon pathways. Simultaneously, sustainable practices such as circular economy adoption, reforestation, and climate-resilient urban planning are crucial to succeeding long-term environmental stability.

Finally, combating global warming requires the collaboration of science, law, policy, and economics, combined with public awareness and active community participation. By integrating these dimensions into consistent strategies, humanity can conquer the encounters of climate change, alleviate its adverse impacts, and achieve an eco-friendly, robust, and viable planet for present and future generations.

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