

Global Pathways to Low-Carbon Economy: Trends, Challenges, and Opportunities

Hatem Mohamed Abdelazim

Head of Economic Research at Asharqia Chamber, Saudi Arabia
hatem.abdelazim@hotmail.com

المسارات العالمية نحو اقتصاد منخفض الكربون: الاتجاهات والتحديات والفرص

حاتم محمد عبد العظيم

رئيس البحوث الاقتصادية بغرفة الشرقية، المملكة العربية السعودية
hatem.abdelazim@hotmail.com

- DOI: [10.21608/ijppe.2025.443493](https://doi.org/10.21608/ijppe.2025.443493) URL: [http://doi.org/ 10.21608/ijppe.2025.443493](http://doi.org/10.21608/ijppe.2025.443493)
- Received: 24/2/2025, Accepted: 17/5/2025
- Citation: Abdelazim, H. (2025). Global pathways to a low-carbon economy: Trends, challenges, and opportunities. The International Journal of Public Policies in Egypt, 4(3), 123-145.

Global Pathways to Low-Carbon Economy: Trends, Challenges, and Opportunities

Abstract

This study investigates the global transition toward a low-carbon economy, with a particular focus on the financing gap required to support the decarbonization of vital economic sectors. Using a qualitative methodology, the study used thematic and document analyses of scholarly literature, international case studies, and policy reports to evaluate strategies and challenges globally. The scope of this study covers developed and developing countries, while the temporal boundary starts from the beginning of the 2000s to projections of 2050. This study examines how nations are moving toward net-zero emissions and the financial obstacles they encounter. The study shows that despite the increasing importance of the global climate, financial flows are still inefficient and not distributed equally. According to the study's findings, implementing strategies to reduce the financing gap, increasing international cooperation, supporting blended finance models, and implementing adaptive policies are the only ways to effectively reach a low-carbon economy. Future studies should design dynamic models, which should also focus on region-specific investment frameworks and impact evaluation tools to align capital flows with the rising demand for climate action more efficiently.

Keywords: Low-carbon economy, climate finance gap, decarbonization, green investments, energy transition

Introduction

The threat that the world is facing today has united global efforts to reduce greenhouse gas (GHG) emissions, making the shift to a low-carbon economy transition reachable. Although clean technologies and policy pledges have achieved significant progress, the lack of financing for clean technologies remains a significant obstacle. This gap is highlighted in sectors such as energy, transportation, industry, buildings, and agriculture, each of which contributes to an increase in global emissions (IPCC, 2022; IEA, 2021a). Without sufficient probate investment, achieving net-zero targets and fulfilling the objectives of the Paris Agreement become increasingly difficult (UNFCCC, 2015).

Despite a significant increase in awareness and huge global promises, the financial flows for implementing low-carbon initiatives remain insufficient (CPI, 2023). These defects are driven by high investment risks in emerging markets, institutional capacity weaknesses in many developing economies, and limitations in international financing of large-scale decarbonization projects (UNCTAD, 2023; UNEP, 2023b). Even in developed countries, funding often goes to mature technologies, which leaves high impact but less proven solutions in a lack of funding (OECD, 2023). This highlights the importance of identifying targeted strategies to close the finance gap and enable an effective transition to low-carbon development.

The main objective of this study is to assess the scale and nature of the financing gap in the decarbonization of key economic sectors such as energy, transportation, industry, building, and agriculture within the broader global transition to a low-carbon economy. This involves examining both the quantity and quality of climate finance flows, identifying the structural, institutional, policy-related obstacles to effective investment, and evaluating the role of innovative financial instruments and international cooperation in bridging these gaps. Therefore, the study tries to generate actionable insights that support the formulation of equitable, scalable, and sector-specific financing strategies aligned with long-term net-zero goals.

To address this objective, the study focuses on:

1. Distinguishing the key barriers affecting decarbonization in the main economic sectors, such as energy, transportation, and industry.
2. Evaluating the involvement of policy frameworks, innovation, and international finance in incentivizing low-carbon investments.
3. Exploring sustainable financing techniques for emerging and developing economies.

These aims lead to the following research questions:

1. How significant is the financing gap for decarbonizing the main sectors globally?
2. What are the main factors contributing to this gap across different regions and sectors?
3. How can international finance, policy innovation, and private sector engagement be used to close this gap and push a low-carbon transition?

It is important to examine the existing literature on climate finance and low-carbon investment to review the financing challenges associated with global decarbonization. The following section reviews the main studies that evaluate the scale of the financing gap, investment needs in the main sectors, and the effectiveness of the current funding mechanisms. It also points to the current obstacles to financing the knowledge gaps this study attempts to fill.

Literature Review

Overview of the Financing Gap

The finance gap preventing the decarbonization of the main sectors, such as energy, transportation industry, building, and agriculture, has been brought to light by the global movement toward a low-carbon economy (International Energy Agency [IEA] 2021a; Intergovernmental Panel on Climate Change [IPCC], 2023). Projections from the IEA (2021b) showed that achieving net-zero emissions by 2050 requires annual clean energy investments to triple from current levels, reaching an estimated USD 4 trillion by 2030. However, recent assessments by the Climate Policy Initiative (CPI, 2022) and Allen and Overy and CPI (2023) showed a continuous deficit between actual and required capital flows, especially in emerging and developing economies. This deficit highlights the pressing need for innovative policy frameworks and blended financing to lower investment risk in low-carbon countries (World Economic Forum [WEF], 2020).

Sector-Specific Insights and Barriers

Energy Sector

The energy sector is the primary focus of decarbonization because it represents the largest portion of global greenhouse gas (GHG) emissions (IPCC, 2022). McCollum et al. (2018) noted that renewable energy technologies, especially wind and solar, have seen huge cost declines, supporting their competitiveness. However, upgrading the grid infrastructure, scaling energy storage, and integrating renewable energy sources require additional capital. Developing nations face heightened risks due to policy uncertainties, inadequate grid capacity, and limited access to long-term financing (OECD 2020). These obstacles create an investment bottleneck, restricting how renewables can replace fossil fuels (IEA 2021a).

Transportation Sector

Electrifying transport systems and developing supportive infrastructure are critical for reducing emissions. While advanced economies have started to scale electric vehicle (EV) adoption, high initial costs and insufficient charging networks remain huge barriers, especially in lower-income regions (World Bank, 2021). According to the IPCC (2022), shifting to low-carbon mobility requires both government and private investment for new infrastructure, subsidies for EV fleets, and research into alternative fuels. Without strong financing instruments, such as green bonds or concessional loans, emerging markets struggle to develop large-scale EV programs (Bataille et al., 2018).

Industrial and Heavy Sectors

Industries that are hard to decarbonize, such as steel, cement, and chemicals, face steep decarbonization costs owing to technological immaturity and high capital expenditure requirements (Bataille et al., 2018). Carbon capture, utilization, and storage (CCUS) technologies present potential solutions, but remain expensive and often lack secure revenue models (United Nations Framework Convention on Climate Change [UNFCCC], 2021). Therefore, private investors hesitate to commit funds without policy guarantees, carbon pricing mechanisms, or public co-investments that lower the investment risk (OECD, 2020).

Role of Policy, Governance, and Innovation

Multiple studies highlight the positive effect of policy support, public-private partnerships, and technological innovation in mobilizing low-carbon finance (IPCC, 2022; World Bank, 2021). Policy instruments such as carbon pricing, emissions trading schemes, and renewable energy mandates can

prompt private sector involvement (CPI, 2022). In addition, international climate finance commitments, such as those embedded in the Paris Agreement, provide grants, concessional loans, and capacity-building programs to developing nations (UNFCCC, 2021). However, the World Economic Forum (2020) mentions that political uncertainty and disjointed global coordination still stand in the way of efficient fund distribution. Meanwhile, innovative technologies such as green hydrogen and advanced battery storage have the potential to reduce emissions, but they need consistent funding and market development to reach a commercial scale (McKinsey & Company, 2021).

Addressing the Climate Finance Gap

The literature always points to a need for blended finance and the strategic use of concessional funding from public sources to promote additional private investment (Allen, Overy, & CPI, 2023; CPI, 2022). This approach helps reduce the risk of large-scale infrastructure projects in developing regions, where credit ratings and political stability may discourage investors from investing (OECD 2020). According to the WEF (2020), risk mitigation tools, such as loan guarantees, insurance products, and first loss capital, can significantly lower the obstacles for private lenders. Similarly, green bonds and sustainability-linked loans have shown success in focusing resources on climate projects, despite the fact that consistent standards and transparent reporting remain critical to building investor confidence (United Nations Environment Programme Finance Initiative [UNEP FI], 2021).

To ensure advantages such as job creation and technology transfer, new frameworks such as Just Energy Transition Partnerships are emerging to integrate financing with social justice (UNFCCC, 2021). According to IPCC (2022), stakeholder involvement and transparent government are necessary to make successful use of strong institutional capability. The United Nations Conference on Trade and Development (UNCTAD, 2023) highlights that increasing the proportion of foreign direct investment (FDI) allocated to green infrastructure in low-income nations is crucial for achieving sustainable development goals and global emissions reduction.

Critical Gaps in Existing Research

While all agree on the deficit of the climate finance gap, the current literature reveals unreliable measurements, unequal methodologies, and incomplete data regarding the allocation of funds across regions and sectors (CPI, 2022; IEA, 2021a). This fragmentation makes it difficult to compare financing flows globally or to mention the most effective policy interventions (OECD, 2020). Moreover, research frequently focuses on either developed or developing countries, which limits our understanding of the most effective cross-regional approach (World Bank, 2021). Climate finance reporting is further complicated by a lack of defined standards for evaluating green investments, which raises questions for investors and politicians (UNEP FI, 2021).

Literature review provides a key element for this study by providing critical insights into the scale of the climate finance gap, the investment needed for major economic sectors, and the current funding techniques. By blending findings from academic research, international institutions, and policy reports, the review helps highlight challenges and knowledge gaps. These insights inform the analytical framework of the current study by guiding it through selecting documents and comparative assessment across regions and sectors. However, the literature review highlighted areas that need to be reviewed. As a result, justifying the need for this study contributes updated policy-relevant knowledge that supports more effective and inclusive low-carbon financing strategies.

In light of this limitation, this study aims at assessing the scale and nature of the financing gap that stands in the way of decarbonizing key economic sectors such as energy, transportation, industry, building, and agriculture within the broader global transition to a low-carbon economy. This involves examining both the quantity and quality of climate finance flows, identifying the structural, institutional, and policy-related obstacles to effective investment, and evaluating the role of innovative financial instruments and international cooperation in bridging these gaps. Therefore, the study tries to generate actionable insights that support the formulation of equitable, scalable, and sector-specific financing strategies aligned with long-term net-zero goals.

Research Methodology

This study adopts a qualitative methodology to explore the financing gap associated with the decarbonization of the main economic sectors within the context of the global transition to a low-carbon economy. A qualitative approach was chosen because of the exploratory and interpretive nature of the research questions, which focus on understanding the structural financial challenges, policy dynamics, and investment patterns across different regions and sectors.

Research Design and Approach

This study is based on document analysis and integrates primary and secondary sources. These include international policy reports, institutional databases, academic journal articles, and case studies from relevant organizations, such as the International Energy Agency (IEA), Intergovernmental Panel on Climate Change (IPCC), Climate Policy Initiative (CPI), and World Economic Forum (WEF). These documents were selected for their relevance and contribution to global climate finance discourse.

Data Collection: Data were collected through a systematic review of publications issued between 2000 and 2025, focusing on achieving investment trends, decarbonization strategies, and financial flows in the main sectors, such as energy, transportation, industry, buildings, and agriculture.

Data Analysis

Thematic analysis was conducted to identify recurring patterns, gaps, and critical issues related to climate finance and sectoral decarbonization. Themes such as financing barriers, investment distribution, policy support, and equity considerations were used to organize and interpret the findings. A comparative analysis across countries (developed vs. developing countries) and sectors was used to highlight inequalities and contextual differences.

Scope and Limitations

The spatial boundary of this study is global, covering high-income, low-income, and middle-income countries. The temporal scope extends from the early 2000s to projections through 2050, reflecting the long-term climate goals.

Global Carbon Dioxide Emissions

Table (1) highlights a huge increase in the total CO₂ emissions from fuel combustion, rising by 7.7% between 2011 and 2022. This surge in emissions significantly amplifies global environmental risks. Consequently, the world strives to transition towards a low-carbon economy and mitigate the overall carbon footprint.

Table 1
Total CO2 emissions - fuel combustion (2011- 2022)

YEAR	MTCO2EQ
2011	31485
2012	31817.5
2013	32416.2
2014	32493
2015	32373.9
2016	32405.3
2017	32935
2018	33688.7
2019	33625.7
2020	31812.6
2021	33674
2022	34116.8

Source: (International Energy Agency, 2025).

Side Effects of Carbon Dioxide Emissions

Human activities have caused an increase in carbon dioxide emissions, the most important of which are (United States Environmental Protection Agency, 2025):

- Burning coal, oil, natural gas, and methane.
- Cutting down trees and not planting trees in their place.
- Using fertilizers.
- Continuous use of air conditioners.
- Dumping plastic and industrial waste into rivers and oceans.

An increase in the temperature of the atmosphere, oceans, and land has caused widespread and rapid changes in the atmosphere, oceans, glaciers, and biosphere, leading to the following:

- Natural disasters (fires, floods, hurricanes, droughts).
- Melting of ice.
- Rising sea and ocean levels.
- Widening of the ozone hole.
- Acid rain.
- Negative impacts on livestock and fish wealth, and the threat of extinction of some animals and fish.

Low-Carbon Economy and Its Importance

A low-carbon economy is characterized by strategically reducing carbon dioxide (CO₂) and other greenhouse gas (GHG) emissions by adopting clean, low-carbon energy sources, such as wind, solar, and hydropower, instead of carbon-intensive fossil fuels. This shift minimizes reliance on coal, oil, and natural gas and aims to mitigate climate change and foster sustainable development (Macquarie University, 2019; United Nations Environment Programme [UNEP], 2025).

Key Benefits of the Low-Carbon Economy

The Key benefits of the low-carbon economy can be summarized as follows:

Climate Change Mitigation

A low-carbon economy plays an important role in slowing global warming and stabilizing the climate by reducing CO₂ emissions. This is particularly critical in safeguarding vulnerable ecosystems, preventing extreme weather events, and meeting the objectives outlined in international climate agreements (Intergovernmental Panel on Climate Change [IPCC], 2022; Stern, N., 2006).

Energy Security and Diversity

Changing the energy mix through renewable sources decreases the dependence on the volatile fossil fuel market and enhances energy security. A steady supply of locally sourced renewables can help countries reduce import bills, stabilize energy prices, and protect themselves against geopolitical risks (International Energy Agency [IEA], 2021b).

Economic Growth and Job Creation

Shifting to low-carbon technologies can accelerate new economic opportunities and create a surge in green jobs, particularly in the renewable energy, energy efficiency, and clean transportation sectors. According to the International Renewable Energy Agency (IRENA), by 2024, the global renewable energy industry already employs millions of people worldwide, which is projected to grow substantially as the demand for clean technologies increases.

Technological Innovation

Investing in research and development for low-carbon solutions, such as advanced batteries, green hydrogen, and carbon capture technologies, often leads to technical innovations that benefit other industries. These innovations help lower production costs, enhance efficiency, and facilitate the broader adoption of clean energy systems (World Economic Forum [WEF], 2020).

Public Health Improvements

Reducing fossil fuel consumption also decreases air pollution, which leads to substantial public health benefits, including lower rates of respiratory diseases, decreased healthcare costs, and improved overall quality of life. Many studies have highlighted the link between transitioning to clean energy and significant gains in population health (World Health Organization [WHO], 2018).

Sustainable Resource Management

A low-carbon economy promotes the efficient use of resources by emphasizing circular economy principles and green infrastructure. This approach not only reduces emissions but also protects water, waste, and biodiversity, ultimately contributing to long-term environmental sustainability (UNEP, 2023b).

Alignment with Global Sustainable Development Goals (SDGs)

Implementing low-carbon strategies increases countries' progress in multiple SDGs, including those related to clean energy (SDG 7), sustainable cities (SDG 11), responsible consumption and production (SDG 12), and climate action (SDG 13). By doing so, nations can foster inclusive growth, reduce inequalities, and strengthen their climate resilience (United Nations, 2015).

Through these benefits, a low-carbon economy goes beyond carbon emissions and forms a holistic framework that integrates economic growth, social welfare, and environmental preservation. As global consensus grows around the urgency of climate action, many countries recognize that

transitioning to a low-carbon model not only mitigates climate risks but also unlocks significant opportunities for sustainable development, innovation, and prosperity.

Global Investments in the Low-Carbon Economy

In 2024, global energy transition technologies investment recorded nearly USD 2.1 trillion, a significant milestone in the ongoing shift toward sustainable energy systems. Although investment in this sector has more than doubled since 2020, reflecting accelerated growth over the past decade, the pace of expansion slowed in 2024, with a reduction in growth of 11% compared to the 24-29 % annual growth rates observed in the preceding three years.

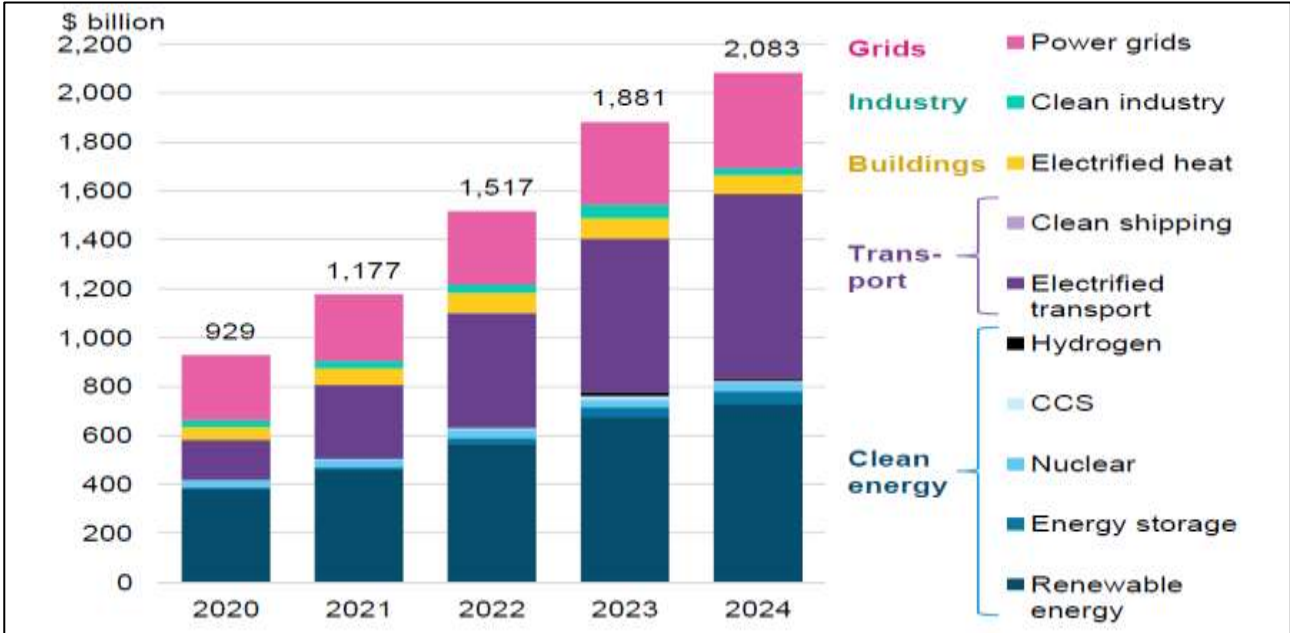
The investment landscape is dominated by three main sectors, collectively accounting for 90% of total spending in 2024: electrified transport (USD 757 billion), renewable energy (USD 728 billion), and power grids (USD 390 billion). Each of these sectors has achieved record investment levels. Electrified transport experienced 20% growth despite concerns about potential slowdowns in electric vehicle adoption. Power grids increased by 15%, and renewable energy increased by 8%.

Energy storage also showed remarkable growth, with a 36% increase in investment, bringing the total to USD 53.9 billion. Clean shipping, which tracks expenditure on zero-emission-capable vessels, saw a fourfold increase to USD 452 million, although this growth came from a relatively small base.

In contrast, other sectors will face mixed outcomes in 2024. Nuclear energy investment remained steady at USD 34.2 billion, while electrified heat declined by 5.2% to USD 77 billion. Carbon capture and storage (CCS) and clean industry investments halved, falling to USD 6.1 billion and USD 27.8 billion, respectively. Hydrogen investment also experienced a significant decline, dropping by 42% to USD 8.4 billion.

These trends underscore the uneven progress across different energy transition sectors. Electrified transport, renewable energy, and power grids continue to drive most of the global investment, whereas other areas face challenges in maintaining momentum. (Bloomberg NEF, 2025) (see Figure 1)

Figure 1
Global investments in energy transition by sector (2020-2024)



Source: (Bloomberg NEF, 2025).

In 2024, Mainland China, frequently identified as a developing economy, significantly increased its lead in energy transition investments, committing USD 818 billion to the sector. This amount is more than double the investments in other economies, solidifying China's dominant position in global energy transition efforts. When standardized for gross domestic product (GDP), China's investment totaled 4.5% of its economic output, far exceeding the EU-27 with a record of 2.0%, the United States with a record of 1.2%, and other major developed countries. This underscores China's outsized commitment to advancing its energy transition agenda, relative to its economic scale.

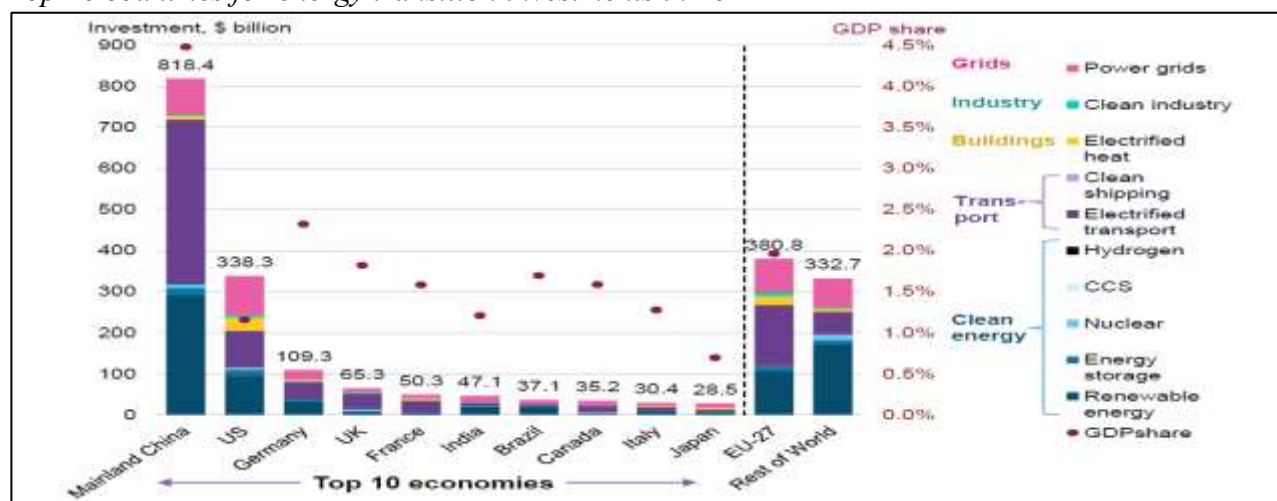
The United States remains the second-largest country in energy transition investment among developed economies, allocating USD 338 billion in 2024. Germany was recorded as the third-largest country in the world, with a record of USD 109 billion, equivalent to 2.3% of its GDP. Despite these high standards, both the United Kingdom and France, which are developed countries, experienced a decline in renewable energy investments.

The top 10 countries are developed and developing economies. India, which is classified as a developing country, is recorded as the sixth largest investor, driven by strong advancements in renewable energy, electric vehicles, and energy storage. Another developing economy, Brazil, was the seventh largest investor, while Canada, a developed country, entered the top 10 list for the first time, replacing Spain. Italy and Japan, both developed nations, rounded out the top 10 countries with slight decreases in their 2024 investments.

The EU-27, which consists of several developed nations, ranks second globally, having invested USD 381 billion in 2024. However, figure (2) shows a 6.5% decline compared to the previous year, signaling challenges in sustaining momentum across the region. These trends underscore the varying commitment levels among developed and developing economies to advance the global energy transition. Notably, China continues to outstrip its peers in absolute and relative terms (Bloomberg, 2025).

Figure 2

*Top 10 countries for energy transition investments in 2022**



*Last data available in 2022

Source: (Bloomberg NEF, 2025).

The Reality of Renewable Energy Worldwide

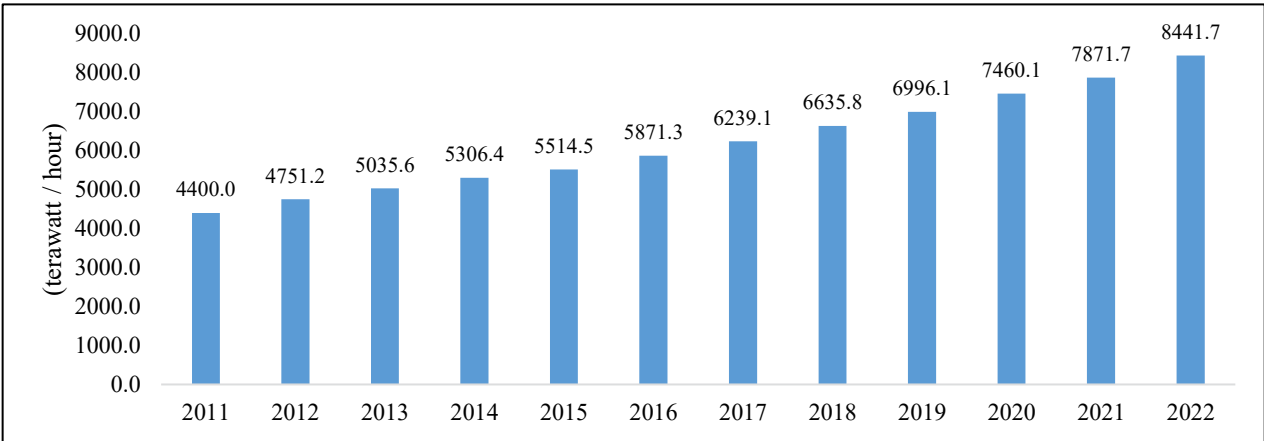
The renewable energy sector is the most important in a low-carbon economy. Its primary advantage is its ability to produce lower emissions than traditional fossil fuels. Moreover, remarkable advancements in renewable energy production technology have led to a substantial decrease in the cost of electrical energy generated from renewable energy sources. This cost reduction has supported

the competitiveness of renewable energy against fossil fuels, positioning it as a viable and environmentally friendly option, as shown in figure (3).

Global Renewable Electricity Generation

Figure (3) shows a consistent upward trend in generating electrical energy from renewable sources. In 2022, it recorded an impressive 8441.7 terawatt-hours, a significant increase from the 4400 terawatt-hours recorded in 2011.

Figure 3
Total electricity generated from renewable energy globally (2011 - 2022)*

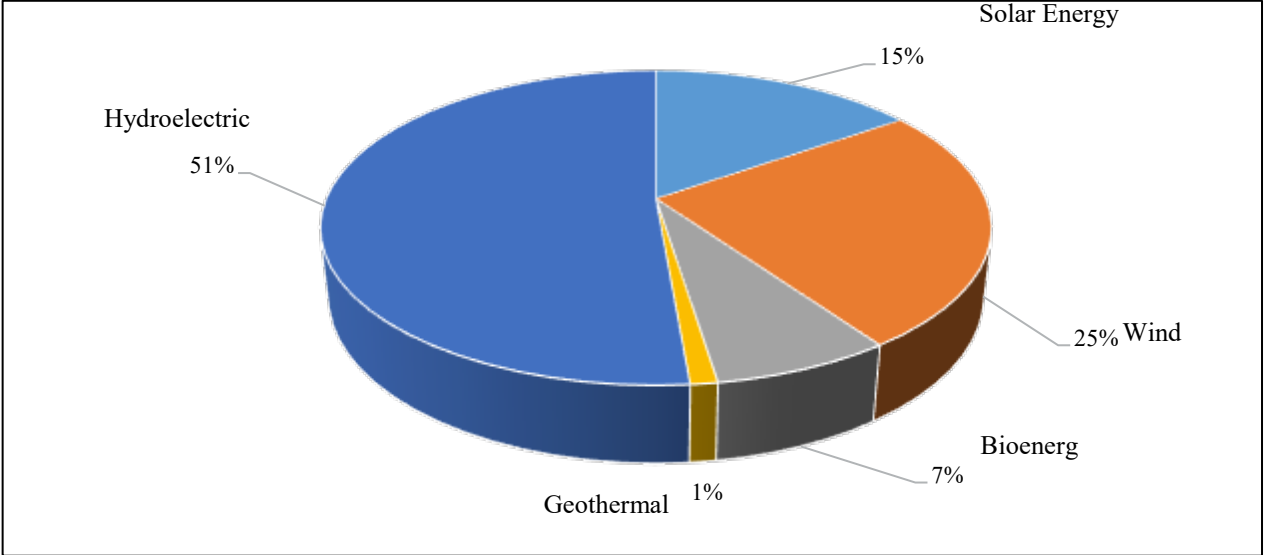


*Last data available in 2022
Source: (International Renewable Energy Agency, 2025a).

Relative Distribution of Renewable Energy Sources (In Terms of Total Electrical Energy Generated in 2022)

Figure (4) reveals that hydroelectric power holds the top position in the total electrical energy generated from renewable energy sources, followed by wind and solar energy.

Figure 4
The relative contribution of renewable energy sources to total electricity generation in 2022*



*Last data available in 2022
Source: (International Renewable Energy Agency, 2025a).

Global Production Costs of Electrical Power Generated from Renewable Energy Sources Between 2011 and 2023

Table (2) reveals that solar photovoltaic energy generation leads the way in terms of reducing production costs in 2023 compared to 2011, followed by concentrated solar power and onshore wind.

Table 2

*Production cost of electrical power from renewable energy sources globally in 2011 and 2023**

RENEWABLE SOURCE	2011 (USD/KWH)	2023 (USD/KWH)	CHANGE PERCENTAGE (%)
SOLAR PHOTOVOLTAIC	0.343	0.044	-87.2
CONCENTRATED SOLAR POWER	0.381	0.117	-69.3
ONSHORE WIND	0.106	0.033	-68.9
OFFSHORE WIND	0.212	0.075	-64.6
GEOHERMAL	0.093	0.071	-23.7
BIOENERGY	0.081	0.072	-11.1
HYDROPOWER	0.041	0.057	39

* Last data available in 2022

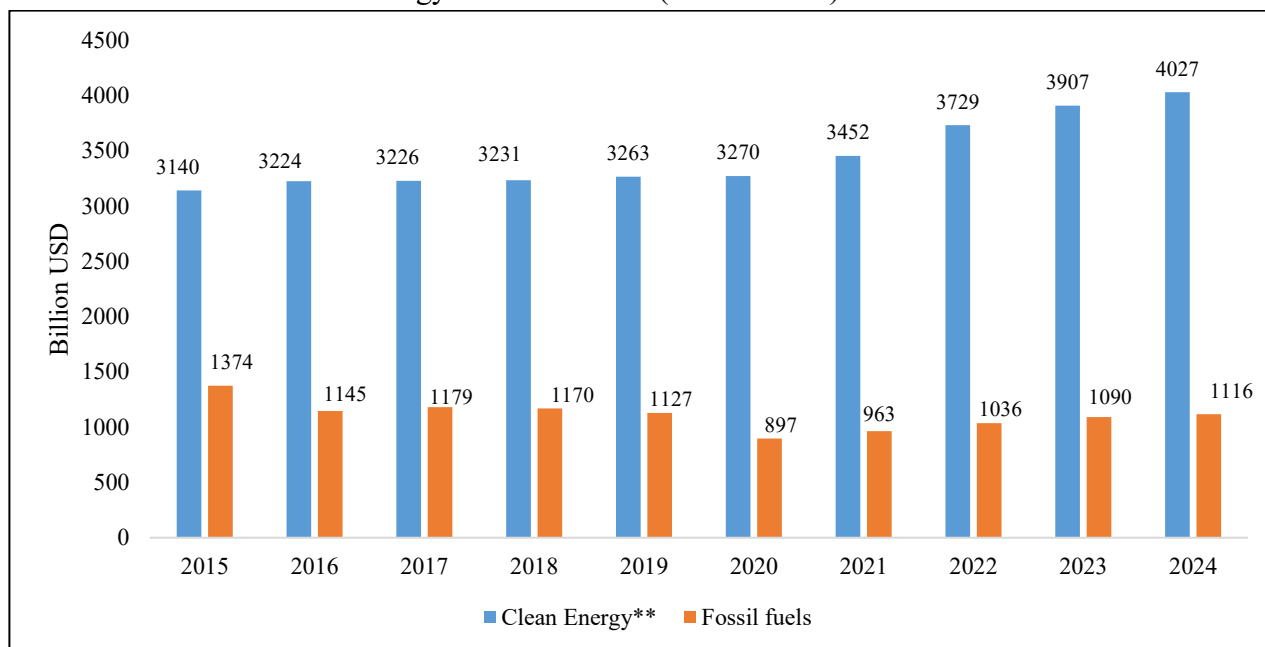
Source: (International Renewable Energy Agency, 2025b).

The Volume of Global Investments in Fossil Fuels and Clean Energy

Figure (5) shows an increase in global investments in clean energy, with a recorded percentage of 28.2% between 2015 and 2024. However, global investment in fossil fuels decreased by 18.8% during the same period.

Figure 5

*Global investment in clean energy and fossil fuels (2015 – 2024)**



*Data available from 2015

**Clean energy includes (low emissions fuels, nuclear and other clean power, energy efficiency, grids and storage, renewable power).

Source: (International Energy Agency, 2024).

The Climate Finance Gap

The Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), released in 2023, provides a comprehensive overview of current climate science and its impacts. It showed that human activities, such as burning fossil fuels, changes in land-use, and processes of producing goods are the primary drivers of climate change. The report mentioned that global surface temperatures will exceed 1.5°C above pre-industrial levels in nearly all scenarios between 2030 and 2035. Global temperatures temporarily breached this edge by 2024 (IPCC, 2024), underscoring the urgent need for immediate and sustained action to curtail greenhouse gas (GHG) emissions across all sectors of the global economy.

The global ambition toward reducing this gap came up with the United Nations Framework Convention on Climate Change (UNFCCC) at the Conference of the Parties (COP). During COP21 in Paris, the parties supported the global goal of maintaining a temperature below 2°C with efforts to pursue a more ambitious target of 1.5°C, recognizing the importance of climate finance in reaching these targets (UNFCCC, 2015). Additionally, COPs, including COP26 in Glasgow and COP27 in Sharm El-Sheikh, confirmed the importance of increasing financing for mitigation and adaptation efforts. However, the annual investments required for the stability of global temperatures still reach trillions, far from the current levels of finance.

COP negotiations have highlighted that the current level of global investment in climate-related initiatives is very low, which causes a substantial financing gap that stands in the way of progress toward meeting climate targets. Reducing this gap requires mobilizing public and private finance through effective policy frameworks and innovative financial instruments. International cooperation, particularly in developing countries, is one of the most important ways to face financial challenges in areas such as mitigation, adaptation, and resilience. Securing sustainable funding not only advances climate action but also contributes to the UN Sustainable Development Goals (SDGs) and supports social equity (World Economic Forum [WEF] 2025).

The Climate Finance Gap in Numbers

The climate finance gap remains a major obstacle in achieving global climate objectives. According to the Climate Policy Initiative (CPI), annual climate finance requirements are raised to reach USD 9 trillion by 2030 and more than USD 10 trillion per year from 2031 to 2050 (Climate Policy Initiative [CPI], 2023). This highlights the rising demand for investment driven by the need to decarbonize major economic sectors and support climate resilience.

Mitigation Finance: Required vs. Actual

Required: Mitigation finance alone must exceed USD 8.4 trillion annually by 2030 (Allen & Overy & CPI, 2023).

Actual: The world invested only USD 1.2 trillion in mitigation during 2021/2022, a more than 85% shortfall from the required annual level.

This gap is mostly in emerging economies and low-income nations, where high capital costs and limited policy support reduce private-sector funding. Despite their more efficient and stronger financial markets, many developed nations face obstacles to the investment needed for emission reductions in sectors such as industry, transportation, and energy.

Adaptation Finance: Growing, But Insufficient

Global financing reached a record USD 63 billion in 2021–2022, with a nearly 29% increase from USD 49 billion in 2019–2020 (CPI, 2023). A large majority (98%) of this funding is issued from public sources, with Development Finance Institutions (DFIs) accounting for 86%. While these figures reflect a positive impact, they are still far from reducing the annual adaptation finance gap of

USD 215–387 billion, primarily affecting developing countries (United Nations Environment Programme [UNEP], 2023a). In addition, UNEP (2023a) estimates that developing nations collectively need 10–18 times the current global public finance dedicated to adaptation.

Developed vs. Developing Countries

Developing countries face annual funding requirements exceeding USD 2.4 trillion by 2030 (United Nations Conference on Trade and Development [UNCTAD], 2023), with USD 1 trillion urgently needed from external sources (UNCTAD, 2023), depending heavily on DFIs, loans, and grants, because of high-risk profiles and limited fiscal space. They also face challenges in terms of the infrastructure and capacity constraints.

Developed countries have efficient financial markets and policy frameworks, but are still far away from the investment needed to meet net-zero goals. They struggle to secure sufficient funding for high-impact areas, such as industrial deep decarbonization, due to cost uncertainties and market barriers. They must mobilize USD 100 billion annually to support the climate efforts of developing countries, which is still insufficient compared to global needs.

The climate finance gap is further compounded by declines in foreign direct investment (FDI). For instance, total FDI contracted by 12% to USD 1.3 trillion in 2022, limiting the capital available for both climate and non-climate projects (UNCTAD, 2023).

The gap between required and actual investments is very large, while developed countries are not yet fully meeting their climate finance commitments, and developing nations are grappling with constrained resources. Despite the increase in adaptation financing, it remains insufficient to protect the region's most vulnerable to climate change. On the mitigation side, the gap between the USD 8.4 trillion needed and USD 1.2 trillion invested shows the real size of the challenge. Addressing these deficits demands coordinated global efforts, including public funding, blended finance arrangements, and policy reforms, to reduce the risk of low-carbon investments in the Global North and South.

The Main Sector Requires Decarbonization to Achieve Low-Carbon Economy Goals

Decarbonizing the main sectors, such as transport, energy, buildings, industry, and agriculture, is important for achieving global climate objectives. However, achieving these goals requires substantial financial investment and strategic innovation, as highlighted in table (3).

While all the main sectors of the global economy require attention regarding decarbonization efforts, the challenges they face are complex. For example, the high cost of the transport sector's electric vehicle (EV) infrastructure is a significant challenge. Similarly, the energy sector requires substantial capital to transition into renewable energy sources. While substantial capital investments are important, strong policies, innovative technologies, and equitable approaches that ensure that the benefits of decarbonization are broadly shared are equally important.

Blended finance plays an important role in mitigating investment risks, particularly in emerging markets and developing economies (EMDEs) and least developed countries (LDCs). Moreover, policy instruments, such as quantity- and price-incentive-based market instruments, can stimulate low-carbon innovation investment in developed and large emerging economies.

Table 3
Total investment required in every sector to achieve low-carbon economy goals (2030 – 2050)

Sector	Actual Investment	Annual Investment By 2030	Annual Investment By 2050	Financing Gap Until 2050
Transport	USD 95.9 billion (2019 – 2020)	USD 2.5 trillion	USD 3.2 trillion	USD 3.1 trillion
Energy	USD 1.74 trillion (2023)	USD 4.5 – 5.7 trillion	USD 125 trillion	USD 123.3 trillion
Building & Infrastructure	USD 14.2 billion (2019 - 2020)	USD 731 billion		USD 716.8 billion
Industrial	USD 10.2 billion (2019 – 2020)	USD 320 – 540 billion		USD 309.8 – 529.8 billion
Agriculture, Forestry, And Other Land Use	USD 6.5 billion (2021 – 2022)	USD 130 billion	-	USD 123.5 billion

Source: (World Economic Forum, 2025).

Transport Sector

The transition to low-carbon transportation demands a large investment, estimated at USD 2.5 trillion annually by 2030 and rising to USD 3.2 trillion by 2050. One of the key areas of low-carbon transportation is electric vehicles (EVs), EV infrastructure, and alternative fuels. However, high upfront costs pose significant challenges, especially in emerging markets with limited disposable income. Blended finance, which combines public and private capital, can help mitigate investment risks and fund essential technologies, such as high-frequency chargers and hydrogen refueling infrastructure.

Ensuring that low-income countries have access to affordable low-emission transport options is crucial. Policies such as subsidies for EVs and green public transport systems are essential for achieving an inclusive transition. Additionally, creating supportive regulatory environments, offering financial incentives, and investing in infrastructure can drive private sector investments and make low-carbon transport compete with high-carbon alternatives.

Public policies should promote green innovation through emission standards, tax incentives, and infrastructure development. Consumer behavior, efficient urban planning, and digitization can also play important roles in reducing emissions and achieving sustainable transport systems. (World Economic Forum, 2025)

Energy Sector

To achieve the Paris Agreement goals for the energy sector, the world requires an estimated USD 125 trillion by 2050, with annual investments of USD 4.5 - 5.7 trillion by 2030. Despite global clean energy investments in 2023 recorded USD 1.74 trillion, this is still very far from the USD 2.7 trillion required to meet climate targets. Also, USD 1.05 trillion was invested in new fossil fuel projects, highlighting the importance of shifting towards renewable energy sources.

To expedite this transformative transition, policymakers should prioritize energy conservation, eliminate fossil fuel subsidies, implement carbon pricing mechanisms, and mandate the use of renewable energy. These measures can promote consumer adoption of clean technologies, such as electric vehicles (EVs) and solar panels, contributing to the decarbonization of the energy sector and reduction of greenhouse gas emissions.

The benefits of decarbonization extend beyond environmental gains, improved air quality, enhanced energy security, and long-term environmental sustainability. A comprehensive approach that includes technological advancements, international collaboration, and public engagement is essential to achieve these objectives. Policymakers must ensure that their strategies are inclusive and consider the needs of vulnerable populations (World Economic Forum, 2025).

Buildings and Infrastructure

Decarbonizing the building sector is important for achieving global climate goals, which require an estimated USD 731 billion in annual investments by 2050. These investments should prioritize enhancing energy efficiency, retrofitting existing structures, and integrating renewable energy sources. The sector's substantial energy consumption, especially for heating and cooling, significantly contributes to greenhouse gas emissions.

However, the financial viability of decarbonizing buildings poses a challenge that requires innovative financing mechanisms to mitigate project risks. Policy changes such as updated building codes and energy performance standards can boost the demand for energy-efficient buildings and attract investment. Carbon pricing and incentives for renewable energy technologies, such as tax credits for solar panels and heat pumps, can further promote their adoption.

Emerging markets and developing economies (EMDEs) and least developed countries (LDCs) face many challenges, including financial and technological barriers and weak enforcement of building codes. Public awareness campaigns can play a crucial role in promoting the adoption of energy-efficient appliances and renewable technologies. Additionally, multilateral development banks (MDBs) support is essential to overcome cost barriers, provide technical assistance in developing building codes, and attract private investment. Fair solutions should prioritize addressing the socio-economic realities in these regions, as outlined by the World Economic Forum (2025).

Industrial Sector

Decarbonizing the industrial sector requires an estimated annual investment of USD 320 to 540 billion by 2050. This huge investment is essential for deploying advanced technologies and optimizing processes in high-emission industries, such as aluminum, cement, steel, chemicals, and shipping. Key strategies for decarbonization include carbon capture, utilization, and storage (CCUS); green hydrogen production; energy efficiency measures; and reducing the demand for high-emission materials.

Blended finance is important in mobilizing capital for industrial decarbonization, especially in countries with underdeveloped financial systems. By collaborating with the public sector, blended financing can reduce the risk of investments, making them more attractive to the private sector. Policy frameworks, such as carbon pricing, energy efficiency standards, and renewable energy mandates, can serve as incentives for adopting low-carbon technologies and encourage long-term investment.

Although technologies such as CCUS and green hydrogen hold promise, they face significant challenges, including high costs and technological immaturity. Governments, such as the UK that invest in CCUS, can be crucial in attracting private sector investments. However, challenges are likely to occur more in emerging markets and developing economies (EMDEs) and least developed countries (LDCs), where limited infrastructure and capacity face obstacles. A comprehensive approach involving substantial investment, strong policy support, and international cooperation is essential to overcome these barriers (World Economic Forum, 2025).

Agriculture, Forestry, and Other Land Use

The agriculture, forestry, and other land use (AFOLU) sector, which accounts for approximately 22% of global greenhouse gas (GHG) emissions, has significant potential for mitigating climate change through practices such as reforestation, afforestation, and improved land management that enhance carbon sequestration. However, achieving decarbonization in this sector demands an estimated USD 130 billion annually by 2030, much higher than current investment levels.

Financial constraints and regulatory uncertainties increase funding challenges in emerging markets and developing economies (EMDEs). Hybrid finance mechanisms such as concessional loans and guarantees can effectively reduce the risk of investments and attract private capital. Additionally, policy tools such as carbon pricing, emission trading schemes, and certification schemes can serve as incentives for adopting sustainable practices and low-carbon technologies.

Technological advancements, including precision agriculture, genetically modified crops, and remote sensing for forestry, have the potential to reduce emissions and optimize carbon sequestration. Additionally, aligning agricultural and land-use policies with climate objectives is important to achieve long-term sustainability and ensure food security. Community engagement and integration of traditional knowledge into modern land management practices can enhance the effectiveness of these strategies (World Economic Forum, 2025).

Factors Driving the Climate Finance Gap

Despite the importance of facing climate change, significant gaps exist between global climate finance needs and actual investment. While developed countries have pledged substantial funds and some progress has been made in mobilizing resources, many developing economies continue to struggle with funding gaps, limited institutional capacity, and high-risk investment environments. This highlights the climate finance challenge, driven by many financial barriers and technological, institutional, and policy-related obstacles on the way of large-scale mitigation and adaptation efforts. The following sections detail these barriers and illustrate how they shape the climate finance landscape for both developed and developing countries.

Public vs. Private Sector Financing

Developed countries have fulfilled their pledge to mobilize USD 100 billion in 2022 (Allen & Overy & Climate Policy Initiative [CPI], 2023). However, this amount remains far below what is required to address the extensive mitigation and adaptation needs of middle- and low-income countries. In many instances, limited government budgets and competing socio-economic priorities stand in the way of public funding for climate-related projects, highlighting the necessity of private sector involvement (OECD, 2023). However, private investors frequently hesitate to commit capital because of the high risk, policy uncertainty, and limited institutional support (Climate Policy Initiative [CPI], 2023; International Energy Agency [IEA], 2021a).

Developed vs. Developing Countries

Developed Countries. Although industrialized nations generally have stronger financial markets and policy frameworks, they still struggle to secure sufficient resources for high-impact areas such as industrial deep decarbonization and energy infrastructure. The climate pledge to provide USD 100 billion annually was only recently approached, reflecting a gap between stated commitments and actual capital flows (Allen, Overy, & CPI, 2023). Moreover, some developed countries experience political and regulatory fluctuations that reduce policy certainty and lead to large-scale private investments (OECD, 2023).

Developing Countries. Developing and emerging economies face several additional challenges, such as weaker institutional capacity, higher imagined risk, and more fiscal limitations (UNCTAD, 2023). Although many have broad Nationally Determined Contributions (NDCs), they often lack detailed energy transition strategies or supportive regulatory frameworks to attract stable, long-term private-sector engagement. Funding deficits, combined with unsatisfactory developmental needs, significantly limit their ability to finance strong mitigation and adaptation measures (United Nations Environment Programme [UNEP], 2023b).

Financial and Investment Barriers

key financial barriers include short-term investor focus, high capital costs, and the absence of predictable returns, making climate projects less attractive under the umbrella of conventional risk–return analyses (CPI, 2023; OECD, 2023). Private investors demand higher rates of return on climate projects, especially in emerging markets (IEA, 2021a). Additionally, donor organizations and multilateral development banks often face difficulties funding climate projects that lack strong feasibility studies or business plans (UNCTAD, 2023; UNEP, 2023a).

Technological and Innovation Gaps

Developing countries frequently need advanced technologies, such as renewable energy systems and climate-resilient agriculture, to meet their NDC goals. However, the high cost and intellectual property constraints of novel or unproven solutions stand in the way these technologies are adopted (CPI, 2023).

Institutional and Policy Constraints

Stable and predictable policies are essential for reducing the risk of climate change. Unfortunately, institutional weaknesses, such as a lack of regulatory clarity, governance challenges, and frequent policy reversals, reduce investor confidence (IEA, 2021a). Even where NDCs are in place, uncertainty in national plans stops large-scale private engagement (OECD 2023). In some emerging and frontier markets, political volatility and corruption concerns increase these institutional barriers, further restricting the flow of climate finance to otherwise high-impact sectors (Allen & Overy & CPI, 2023).

Project Pipeline and Technical Capacity

The shortage of “bankable” climate projects is a major obstacle to investment. Many proposed initiatives lack essential feasibility studies, technical assessments, or clearly defined revenue models (UNCTAD, 2023; UNEP, 2023a). Without such groundwork, even donor agencies committed to financing climate actions find it challenging to allocate funds. Limited technical expertise to design and implement complex climate projects also stands in the way of effective deployment, especially in low-income and small-island developing states.

Fragmentation and Lack of Standardization

Fragmentation within the global financial system, driven by geopolitical constraints and low coordination among funding sources, creates inefficiencies, resulting in underinvestment, especially in the developing world (CPI 2023). The absence of standardized metrics and methodologies for measuring and reporting climate finance adds further unpredictability (UNEP 2023a). As a result, investors face difficulties in assessing project risks and returns, thereby limiting private capital’s involvement in large-scale, high-risk mitigation or adaptation projects.

Conclusion

The transition to a low-carbon economy is no longer a distant dream but an urgent requirement in the face of escalating climate change and its far-reaching consequences for the environment, society, and economy. This study examined the global trends, challenges, and opportunities associated with this transformative shift, emphasizing the important role of renewable energy, electrified

transportation, and power grids in driving away from traditional carbon systems. Despite substantial investments in low-carbon technologies, recorded at nearly USD 2.1 trillion in 2024, the gap is still huge, especially in financing, policy frameworks, and technological advancements. Developing countries face significant obstacles in mobilizing the resources necessary to meet global climate targets.

This study shows the difference in progress across sectors and regions, with electrified transportation, renewable energy, and power grids leading the charge. Conversely, other areas, such as hydrogen, carbon capture and storage (CCS), and electrified heating, have made little progress. The climate finance gap remains a critical challenge, with current investments far from the USD 9 trillion annually required by 2030 to achieve global climate goals. To bridge this gap, unprecedented levels of international cooperation, innovative financing mechanisms, and strong policy frameworks are required.

The transition to a low-carbon economy presents huge opportunities for economic growth, job creation, and technological innovations. However, achieving these benefits requires a comprehensive and equitable approach that ensures no country or community remains behind. This study's findings highlight the need for coordinated action across governments, businesses, and civil society to accelerate the global energy transition and pave the way toward a sustainable and low-carbon future.

Recommendations

To address the challenges highlighted in this study and expedite the transition to a low-carbon economy, the following recommendations are proposed:

- Increasing the climate finance commitments globally, especially from developed to developing countries.
- More specifically, innovative financing models such as blended finance, green bonds, and PPPs can be used to de-risk and attract private capital in low-carbon projects.
- Promoting stable long-term policy frameworks, such as carbon pricing and energy efficiency policies, to support investor confidence.
- International collaboration should be promoted, especially in technology transfer, building capacities, and knowledge sharing.
- More research and product innovation should be invested in new clean technologies, such as green hydrogen and energy storage.
- Strengthening the MDB's contribution to climate finance coordination and closing the gap between emerging markets and project pipelines.
- Building public awareness and promoting community engagement to accelerate the adoption of low-carbon behavior and technology.

By implementing these recommendations, the global community can reduce the climate finance gap, promote a transition to a low-carbon economy, and achieve the Paris Agreement goals. A sustainable, equitable, and resilient future is achievable, but it demands collective action, bold leadership, and commitment from all stakeholders.

Limitations and Constraints of the Study

While the study highlights the description of the climate finance gap and the policy instruments needed to support low-carbon transition, there are some limitations to be noted.

First, the study primarily relied on secondary sources, which could have a difference in data reporting and methodological variation between the institutions.

Second, the study is more focused on global and new marketplace trends, which do not necessarily depend on region-based information or national studies.

These limitations highlight the need for real-time data and context studies to guide policy actions.

Future Research Directions

Future research must further the results of the current study by exploring the following areas:

- Establishing strong methodologies for tracking private sector climate finance flows, particularly in emerging and developing economies.
- Conducting comparative studies on blended finance to reduce risk in different national and sectoral sectors
- Studying the socio-economic implications of climate finance implementation to achieve equitable transitions, especially in vulnerable societies.

Implications for Implementation

Efficient use of the present study's findings also requires efforts across different levels of government and stakeholders.

- National governments must adapt climate finance to long-term policy discussions and establish enabling regulatory frameworks.
- International organizations and development banks must take the lead in designing blended finance models that can be developed and deliver technical assistance to underserved nations.
- Private-sector entities should be encouraged to align their portfolios with low-carbon transitions by sharing risk mechanisms and reporting formats.

Success will depend not only on policy design but also on political will, institutional capacities, and trust among various actors worldwide.

References

- Allen & Overy, & Climate Policy Initiative. (2023). How big is the net zero financing gap? <https://www.climatepolicyinitiative.org/wp-content/uploads/2023/09/How-big-is-the-Net-Zero-financing-gap-2023.pdf>.
- Bataille, C., Åhman, M., Neuhoﬀ, K., Nilsson, L., Fischedick, M., Lechtenböhmer, S., ... & Rahbar, S. (2018). A review of technology and policy deep decarbonization pathway options for making energy-intensive industry production consistent with the Paris Agreement. *Journal of Cleaner Production*, 187, 960–973. <https://doi.org/10.1016/j.jclepro.2018.03.107>.
- BloombergNEF. (2025). *Energy transition investment trends 2025*. [Energy Transition Investment Trends | BloombergNEF](https://www.bloombergnef.com/energy-transition-investment-trends-2025).
- Climate Policy Initiative. (2023). *Global landscape of climate finance 2023*. <https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2023/>.
- Intergovernmental Panel on Climate Change (IPCC). (2022). *Climate change 2022: Mitigation of climate change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press. <https://www.ipcc.ch/report/ar6/wg3/>.
- Intergovernmental Panel on Climate Change (IPCC). (2023). *Climate change 2023: Synthesis report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. [IPCC AR6 SYR LongerReport.pdf](https://www.ipcc.ch/report/ar6/syr/longer-report/).
- Intergovernmental Panel on Climate Change (IPCC). (2024). *IPCC Chair's remarks at the High-Level Ministerial Roundtable on Pre-2030 Ambition, COP29, Baku, Azerbaijan*. <https://www.ipcc.ch/2024/11/18/ipcc-chairs-cop29-high-level-ministerial-roundtable-pre-2030-ambition>.
- International Energy Agency (IEA). (2021a). *Financing clean energy transitions in emerging and developing economies*. <https://www.iea.org/reports/financing-clean-energy-transitions-in-emerging-and-developing-economies>.
- International Energy Agency (IEA). (2021b). *Net zero by 2050: A roadmap for the global energy sector*. <https://www.iea.org/reports/net-zero-by-2050>.
- International Energy Agency (IEA). (2024). *World energy investment 2024*. <https://www.iea.org/reports/world-energy-investment-2024>.
- International Energy Agency (IEA). (2025). *Total CO₂ emissions 2025*. <https://www.iea.org/data-and-statistics>.
- International Renewable Energy Agency (IRENA). (2025a). *Electricity generation statistics 2025*. <https://www.irena.org/Statistics/View-Data-by-Topic/Capacity-and-Generation/Technologies>.
- International Renewable Energy Agency (IRENA). (2025b). *Global trends: Statistics 2025*. <https://www.irena.org/Data/View-data-by-topic/Costs/Global-Trends>.
- Macquarie University. (2019). *What is a low-carbon economy?* <https://lighthouse.mq.edu.au/article/please-explain/march-2019/what-is-a-low-carbon-economy>.
- McCollum, D., Zhou, W., Bertram, C., De Boer, H.-S., Bosetti, V., Busch, S., ... & Tavoni, M. (2018). Energy investment needs for fulfilling the Paris Agreement and achieving the Sustainable Development Goals. *Nature Energy*, 3(7), 589–599. <https://doi.org/10.1038/s41560-018-0179-z>.
- McKinsey & Company. (2021). *The net-zero transition: What it would cost, what it could bring*. <https://www.mckinsey.com/business-functions/sustainability/our-insights/the-net-zero-transition-what-it-would-cost-what-it-could-bring>.
- Organisation for Economic Cooperation and Development (OECD). (2020). *Developing sustainable finance definitions and taxonomies*. [Developing Sustainable Finance Definitions and Taxonomies | OECD](https://www.oecd.org/finance/developing-sustainable-finance-definitions-and-taxonomies/).
- Organisation for Economic Cooperation and Development (OECD). (2023). *Scaling up the mobilisation of private finance for climate action in developing countries: Challenges and opportunities for international providers*. [OECD Economic Outlook, Volume 2023 Issue 1 | OECD](https://www.oecd.org/eo/oeo-economic-outlook-volume-2023-issue-1/).
- Stern, N. (2006). *The economics of climate change: The Stern review*. Cambridge University Press.
- United Nations Conference on Trade and Development (UNCTAD). (2023). *World investment report: Investing in sustainable energy for all*. <https://unctad.org/publication/world-investment-report-2023>.
- United Nations Environment Programme Finance Initiative (UNEP FI). (2021). *Rethinking impact to finance the SDGs*. <https://www.unepfi.org/publications/rethinking-impact-to-finance-the-sdgs/>.

- United Nations Framework Convention on Climate Change (UNFCCC). (2021). *Biennial assessment and overview of climate finance flows*. <https://unfccc.int/topics/climate-finance/resources/biennial-assessment-of-climate-finance>.
- United Nations Environment Programme. (2025). *The sectoral solution to climate change*. [The Sectoral Solution to Climate Change](#).
- United Nations Environment Programme. (2023a). *Adaptation gap report 2023: Underfinanced. Underprepared*. <https://www.unep.org/resources/adaptation-gap-report-2023>.
- United Nations Environment Programme. (2023b). *Emissions gap report 2023: Broken record – Temperatures hit new highs, yet the world fails to cut emissions (again)*. <https://www.unep.org/resources/emissions-gap-report-2023>.
- United Nations Environment Programme. (2025). *Green Economy*. [Green Economy | UNEP - UN Environment Programme](#).
- United Nations Framework Convention on Climate Change (UNFCCC). (2015). *Adoption of the Paris Agreement (COP21) [FCCC/CP/2015/L.9/Rev.1]*. <https://unfccc.int/resource/docs/2015/cop21/eng/109r01.pdf>.
- United Nations. (2015). *Transforming our world: The 2030 agenda for sustainable development*. <https://sdgs.un.org/2030agenda>.
- United States Environmental Protection Agency (EPA). (2025). *Carbon monoxide's impact on indoor air quality*. <https://www.epa.gov/indoor-air-quality-iaq/carbon-monoxides-impact-indoor-air-quality>.
- World Bank. (2021). *Decarbonizing cities by improving public transport and managing land use and traffic*. [TDI-paper-Decarbonizing-Cities-by-Improving-Public-Transport-and-Managing-Land-Use-and-Traffic-October-2021.pdf](#).
- World Economic Forum (WEF). (2020). *The green investment report: The ways and means to unlock private finance for green growth* [WEF GreenInvestment Report 2013.pdf](#)
- World Economic Forum. (2025). *Bridging the gap: How to finance the net-zero transition*. <https://www.weforum.org/reports/bridging-the-gap-how-to-finance-the-net-zero-transition>.
- World Health Organization (WHO). (2018). *Air pollution and child health: Prescribing clean air*. <https://www.who.int/publications/i/item/air-pollution-and-child-health>.

List of Abbreviations

AFOLU	Agriculture, Forestry, and Other Land Uses
CCS	Carbon capture and storage
CCUS	Carbon Capture, Utilization, and Storage
CO₂ emissions	Carbon Dioxide Emissions
COP	Conference of the Parties
EMDs	Emerging Market and Developing Economies
EV	Electric Vehicle
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GHG	Green House Gas
LDCs	Least developed countries
MDBs	Multilateral Development Banks
SDGs	Sustainable Development Goals

المسارات العالمية نحو اقتصاد منخفض الكربون: الاتجاهات والتحديات والفرص

المستخلص

في هذه الدراسة، يجري استقصاء التحول العالمي نحو اقتصاد منخفض الكربون، مع تركيز خاص على الفجوة التمويلية اللازمة لدعم إزالة الكربون في القطاعات الاقتصادية الحيوية. وتعتمد الدراسة منهجية نوعية من خلال تحليل الوثائق والتحليل الموضوعي للأبحاث والتقارير والدراسات الدولية، لتقييم الاستراتيجيات والتحديات على المستوى العالمي. ويغطي النطاق المكاني كلا من الدول المتقدمة والنامية، فيما يمتد النطاق الزمني من أوائل العقد الأول من الألفية الثالثة وصولاً إلى التوقعات المستقبلية لعام 2050. كما يناقش مدى تقدم الدول نحو تحقيق انبعاثات كربونية صفرية والعوائق المالية التي تعترض سبيلها. وتُظهر الدراسة أنه على الرغم من تزايد أهمية المناخ العالمي، فإن التدفقات المالية لا تزال غير فعالة وغير موزعة بالتساوي. وتخلص الدراسة إلى أن السبيل الوحيد للوصول بفاعلية إلى اقتصاد منخفض الكربون هو تطبيق استراتيجيات لتقليص فجوة التمويل، وزيادة التعاون الدولي، ودعم نماذج التمويل المختلط، وتطبيق سياسات تكيفية. وينبغي للدراسات المستقبلية أن تركز على تصميم نماذج ديناميكية، كما ينبغي لها أن تركز على أطر الاستثمار الخاصة بكل منطقة وأدوات تقييم الأثر لمواءمة تدفقات رأس المال مع الطلب المتزايد على العمل المناخي بطريقة أكثر كفاءة.

الكلمات الدالة: الاقتصاد منخفض الكربون، فجوة تمويل المناخ، إزالة الكربون، الاستثمارات الخضراء،

التحول في مجال الطاقة