

GLOBAL INVESTMENT OPPORTUNITIES IN CLEAN ENERGY

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Abstract:

The transition to green energy is essential for mitigating climate change and achieving global sustainability goals. However, financing renewable energy projects remains a significant challenge due to their high upfront costs and perceived risks. This article explores effective strategies for financing green energy initiatives, highlighting innovative mechanisms such as public-private partnerships, green bonds, crowdfunding, and blended finance. It also examines the role of government policies, including tax incentives and subsidies, in attracting private investment. Additionally, the article discusses emerging tools like corporate power purchase agreements (PPAs), energy performance contracts (EPCs), and international climate funds, which provide stable funding streams and reduce financial barriers. By leveraging these diverse financing approaches, stakeholders can overcome capital constraints, accelerate the deployment of renewable energy, and drive the global transition toward a sustainable energy future.

Key words: *investment, green energy, renewable capacity, solar PV, grid*

infrastructure, financing.

Introduction.

The global push toward sustainability has placed green energy at the forefront of efforts to combat climate change and reduce reliance on fossil fuels. Renewable energy projects, such as solar, wind, and hydropower, offer a cleaner, more sustainable alternative to traditional energy sources. However, despite their environmental benefits, these projects often face significant financial hurdles. High upfront costs, long payback periods, and perceived risks can deter investors and stall progress. As the demand for clean energy grows, finding effective ways to finance green energy projects has become a critical priority.

This article delves into the various financing mechanisms that can unlock the potential of renewable energy initiatives. From public-private partnerships and green bonds to innovative tools like crowdfunding and blended finance, we explore how diverse strategies can address the unique challenges of funding green energy. Additionally, we examine the role of government policies, international climate funds, and corporate commitments in driving investment. By understanding and leveraging these financing options, stakeholders can overcome barriers, accelerate the adoption of renewable energy, and contribute to a more sustainable and resilient future.

Review of Literature on the Subject.

The financing of green energy projects has garnered significant attention in recent years, as the global community seeks to address climate change and transition to sustainable energy systems. A growing body of literature highlights the challenges and opportunities associated with funding renewable energy initiatives, emphasizing the need for innovative financing mechanisms and supportive policies. This review synthesizes key findings from existing research on the topic.

Public-private partnerships have been widely recognized as an effective way to mobilize resources for green energy projects. Studies by Delmon (2017) emphasize that government guarantees and policy support are critical in attracting private investment, particularly in developing countries where financial risks are higher. [1]

Green bonds have emerged as a popular financing tool for environmentally friendly projects. Research by Zerbib (2019) highlights that green bonds not only provide capital but also enhance the reputation of issuers by aligning with environmental, social, and governance (ESG) goals. [2]

Crowdfunding and community-based financing models have gained traction as alternative funding sources for green energy. Bauwens and Devine-Wright (2018) argue that these models democratize access to renewable energy investments and foster local engagement. [3] Case studies by Seyfang et al. (2014) demonstrate the success of community solar projects in Europe, where collective investment has enabled small-scale renewable energy deployment. [4]

Blended finance, which combines public and private funds, has been identified as a key strategy for de-risking green energy investments. Bhattacharya et al. (2019) emphasize the role of blended finance in bridging the funding gap for renewable energy projects in low-income countries. [5]

Government policies, such as tax incentives, subsidies, and feed-in tariffs, play a crucial role in promoting green energy investments. Research by Johnstone et al. (2010) demonstrates that well-designed incentives can significantly reduce the cost of renewable energy projects and accelerate their adoption. [6]

Energy performance contracts have been effective in financing energy efficiency and renewable energy projects. Case studies by Marino et al. (2010) show that this model has been successfully applied in public sector buildings, schools, and hospitals. [7]

International climate funds, such as the Green Climate Fund (GCF) and the Global Environment Facility (GEF), have been instrumental in supporting green energy projects in developing countries. Nakhooda et al. (2015) emphasize that these funds provide critical financial resources and technical assistance, enabling countries to overcome barriers to renewable energy deployment. [8]

Corporate PPAs have gained prominence as a financing mechanism for renewable energy. Research by Knoope et al. (2020) highlights the role of PPAs in reducing carbon footprints and enhancing corporate sustainability.

Research methodology.

The research methodology for this study primarily involved gathering data from official government documents, reports issued by international organizations, and scientific publications. The collected information was analyzed using a structural-analytical approach,

assessing the current state of the field and the impact of reforms through statistical and theoretical examination. Additionally, a comparative analysis was conducted during the evaluation process, leading to the development of key conclusions.

Analysis and results.

Global energy investment is set to exceed USD 3 trillion for the first time in 2024, with USD 2 trillion going to clean energy technologies and infrastructure. Investment in clean energy has accelerated since 2020, and spending on renewable power, grids and storage is now higher than total spending on oil, gas, and coal.

As the era of cheap borrowing comes to an end, certain kinds of investment are being held back by higher financing costs. However, the impact on project economics has been partially offset by easing supply chain pressures and falling prices. Solar panel costs have decreased by 30% over the last two years, and prices for minerals and metals crucial for energy transitions have also sharply dropped, especially the metals required for batteries.

The annual World Energy Investment report has consistently warned of energy investment flow imbalances, particularly insufficient clean energy investments in EMDE outside China. There are tentative signs of a pick-up in these investments: in our assessment, clean energy investments are set to approach USD 320 billion in 2024, up by more 50% since 2020. This is similar to the growth seen in advanced economies (+50%), although trailing China (+75%). The gains primarily come from higher investments in renewable power, now representing half of all power sector investments in these economies. Progress in India, Brazil, parts of Southeast Asia and Africa reflects new policy initiatives, well-managed public tenders, and improved grid infrastructure. Africa's clean energy investments in 2024, at over USD 40 billion, are nearly double those in 2020.

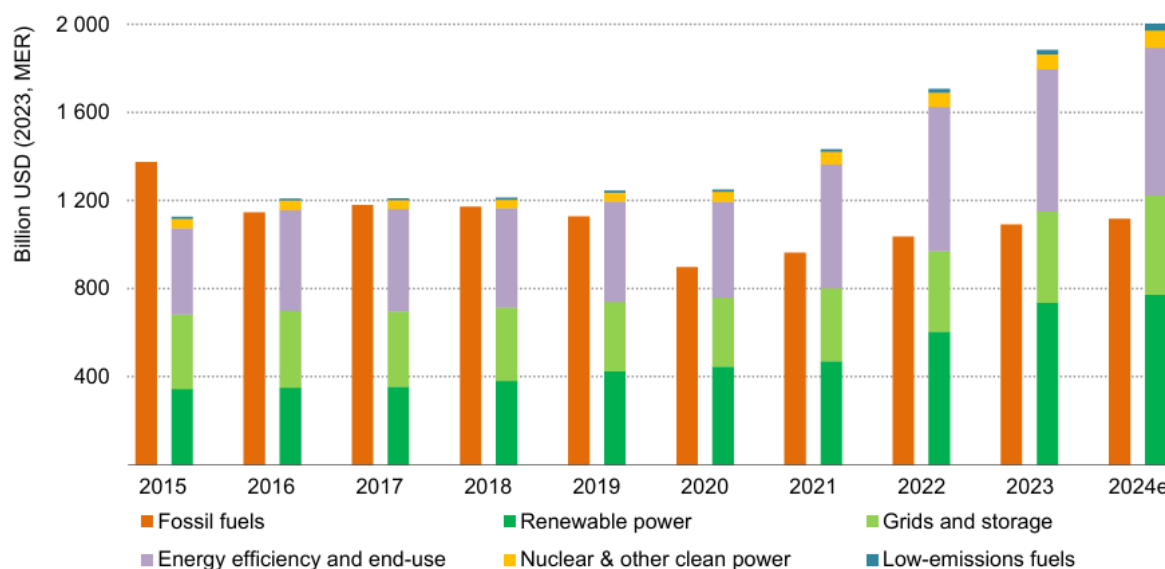


Figure 1. Global investment in clean energy and fossil fuels. [9]

Yet much more needs to be done. In most cases, this growth comes from a very low base and many of the least-developed economies are being left behind (several face acute problems servicing high levels of debt). In 2024, the share of global clean energy investment in EMDE outside China is expected to remain around 15% of the total. Both in terms of volume and

share, this is far below the amounts that are required to ensure full access to modern energy and to meet rising energy demand in a sustainable way.

Power sector investment in solar photovoltaic (PV) technology is projected to exceed USD 500 billion in 2024, surpassing all other generation sources combined. Though growth may moderate slightly in 2024 due to falling PV module prices, solar remains central to the power sector's transformation. In 2023, each dollar invested in wind and solar PV yielded 2.5 times more energy output than a dollar spent on the same technologies a decade prior.

In 2015, the ratio of clean power to unabated fossil fuel power investments was roughly 2:1. In 2024, this ratio is set to reach 10:1. The rise in solar and wind deployment has driven wholesale prices down in some countries, occasionally below zero, particularly during peak periods of wind and solar generation. This lowers the potential for spot market earnings for producers and highlights the need for complementary investments in flexibility and storage capacity.

Investments in nuclear power are expected to pick up in 2024, with its share (9%) in clean power investments rising after two consecutive years of decline. Total investment in nuclear is projected to reach USD 80 billion in 2024, nearly double the 2018 level, which was the lowest point in a decade.

Grids have become a bottleneck for energy transitions, but investment is rising. After stagnating around USD 300 billion per year since 2015, spending is expected to hit USD 400 billion in 2024, driven by new policies and funding in Europe, the United States, China, and parts of Latin America. Advanced economies and China account for 80% of global grid spending. Investment in Latin America has almost doubled since 2021, notably in Colombia, Chile, and Brazil, where spending doubled in 2023 alone. However, investment remains worryingly low elsewhere.

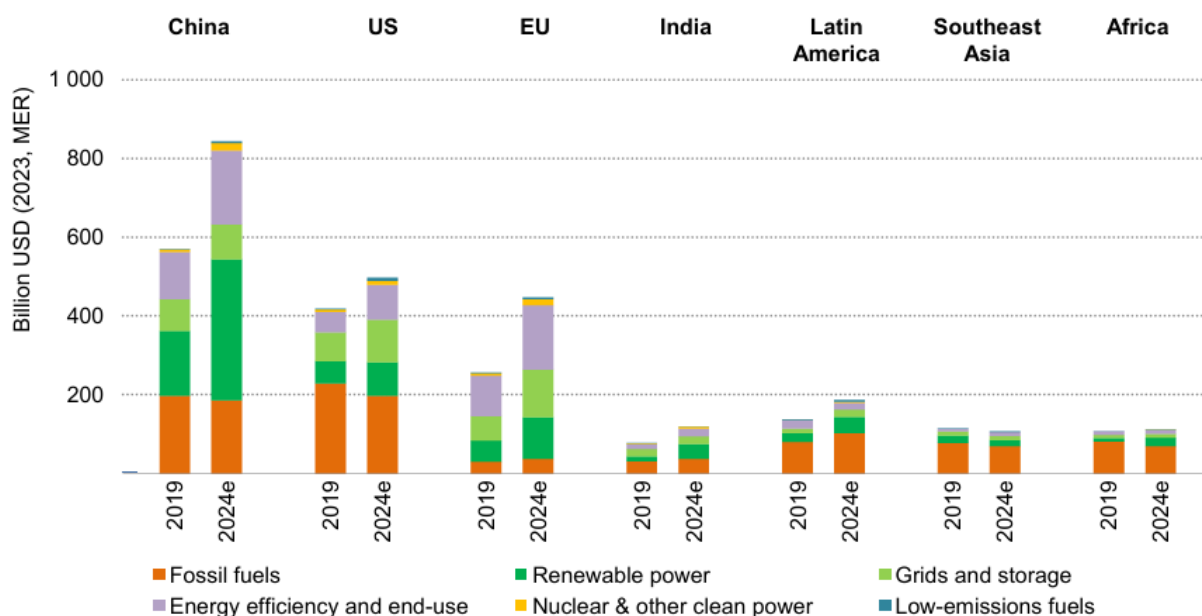


Figure 2. Annual energy investment by selected country and region, 2019 and 2024e. [10]

Investments in battery storage are ramping up and are set to exceed USD 50 billion in 2024. But spending is highly concentrated. In 2023, for every dollar invested in battery storage in advanced economies and China, only one cent was invested in other EMDE.

Investment in energy efficiency and electrification in buildings and industry has been quite resilient, despite the economic headwinds.

But most of the dynamism in the end-use sectors is coming from transport, where investment is set to reach new highs in 2024 (+8% compared to 2023), driven by strong electric vehicle (EV) sales.

The rise in clean energy spending is underpinned by emissions reduction goals, technological gains, energy security imperatives (particularly in the European Union), and an additional strategic element: major economies are deploying new industrial strategies to spur clean energy manufacturing and establish stronger market positions. Such policies can bring local benefits, although gaining a cost-competitive foothold in sectors with ample global capacity like solar PV can be challenging. Policy makers need to balance the costs and benefits of these programmes so that they increase the resilience of clean energy supply chains while maintaining gains from trade.

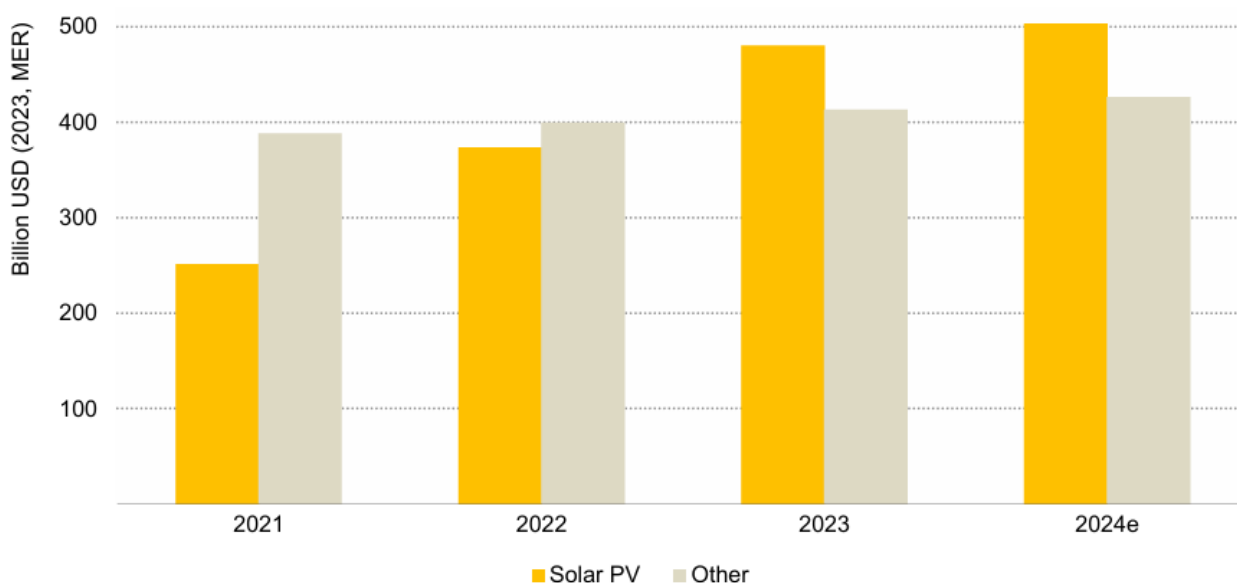


Figure 3. Global annual investment in solar PV and other generation technologies, 2021-2024e. [11]

In the United States, investment in clean energy increases to an estimated more than USD 300 billion in 2024, 1.6 times the 2020 level and well ahead of the amount invested in fossil fuels. The European Union spends USD 370 billion on clean energy today, while China is set to spend almost USD 680 billion in 2024, supported by its large domestic market and rapid growth in the so-called “new three” industries: solar cells, lithium battery production and EV manufacturing.

Conclusion and suggestions.

Financing green energy projects is a cornerstone of the global transition to a sustainable and low-carbon future. While the challenges of high upfront costs, long payback periods, and perceived risks are significant, the literature and real-world examples demonstrate that innovative financing mechanisms can effectively address these barriers. Public-private partnerships, green bonds, crowdfunding, blended finance, and corporate power purchase agreements (PPAs) have all proven to be viable tools for mobilizing capital and reducing

investment risks. Additionally, government policies, such as tax incentives and subsidies, play a pivotal role in creating an enabling environment for renewable energy investments.

The success of green energy financing also hinges on international cooperation, as evidenced by the contributions of climate funds like the Green Climate Fund (GCF) and the Global Environment Facility (GEF). These initiatives provide critical support to developing countries, enabling them to overcome financial and technical barriers to renewable energy deployment. Furthermore, emerging mechanisms such as green banks and yieldcos are expanding the financing landscape, offering new opportunities for investors and project developers alike.

As the urgency to combat climate change intensifies, the need for scalable and sustainable financing solutions will only grow. By leveraging a combination of traditional and innovative approaches, stakeholders can unlock the full potential of green energy projects, driving economic growth, environmental preservation, and social equity. The path to a sustainable energy future is clear, but it requires continued collaboration, innovation, and commitment from governments, businesses, and communities worldwide. With the right financing strategies in place, green energy projects can become a cornerstone of a resilient and prosperous global economy.

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