



# Advance Journal of Econometrics and Finance

## Advance Journal of Econometrics and Finance

Online ISSN

2959-8990

Print ISSN

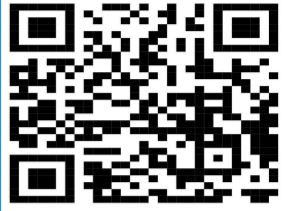
2959-8982

<https://ajeaf.com/index.php/Journal/About>

Name of Publisher: SCHOLAR CRAFT EDUCATION & RESEARCH HUB

Review Type: Double Blind Peer Review

Journal Frequency: Quarterly Research Journal (4- Issue)



### Decarbonizing Pakistan: The Influence of Green Finance on Renewable Energy and Environmental Sustainability

<sup>1</sup>Sumera Mehmood, <sup>\*2</sup>Dr. Asghar Kamal

	<b>Abstract</b>
<p><b>Sumera Mehmood</b> PhD Scholar and Lecturer of Finance, Iqra University, Karachi, Pakistan</p> <p><b>Dr. Asghar Kamal*</b> Assistant Professor, Department of Business Administration, Sarhad University, Peshawar. Corresponding Author Email: <a href="mailto:asgharkamal5523@gmail.com">asgharkamal5523@gmail.com</a></p>	<p>This study aims at assessing the impact of green finance and renewable energy in enhancing environmental sustainability in Pakistan. It examines the link between financial investment, policies and renewable energy and the challenges that hinder their efficiency. The sample includes Pakistan, and data is collected on a large set of variables from 2013 to 2022, with varying availability across indicators. In this context, green finance is assigned by investments of renewable energy, energy efficiency and green bonds, while the environmental sustainability is defined with energy transition and lower pollution levels. Having determined that green finance policies are used to tackle environmental degradation, this paper employs regression analysis. Thus, it can be concluded that despite the fact that green finance, and specifically investments in renewable energy have a number of beneficial environmental impacts, these have various limitations that are financial, political, infrastructural, and regulatory in nature. These findings suggest that financial and monetary incentives, coupled with technological improvement, and institutional changes should form the core of the policy interventions designed for Pakistan's climate changes and green economy.</p>
<b>Keywords:</b>	Green Finance, Renewable Energy, Environmental Sustainability, Pakistan, Carbon Emission, Climate Change



# Advance Journal of Econometrics and Finance

## Introduction:

### Background

Today, the issue of climate change and sustainable development are highly relevant and green finance and energy stand as the driving force in creating opportunities for growth and change (Ahmad & Khan, 2024; Bano et al., 2022, p. 24). Pakistan as a country is experiencing a number of environmental problems including air pollution, water deficits, and natural calamities (Farooq and Khan, 2023; (Sharif et al., 2023). Green finance involves a financial injection in sustainability projects and sustainable services like energy, efficient use of energy, waste, and management, among others (Awan & Akhtar, 2020; Afzal et al., 2022). Green energy, on the other hand, is energy that has a low impact on the environment and includes solar, wind, and hydropower energy (Ali, Wang, & Akbar, 2023). The global move towards green economy has forced Pakistan to come up with policies and strategies that seek to minimize carbon footprint and enhance the utilization of renewable energy (Cheema & Jabeen, 2021; Hussain & Gul, 2020).

Nevertheless, the role of green finance and energy in the improvement of the environment is still questionable in the context of Pakistan (Mehmood, Abdi, & Ali, 2023). Despite the efforts made by the country to promote renewable energy and environmental investment, there are some barriers that include; financial constraints (Ahmad & Khan, 2024), political instability inadequate infrastructure and lack of awareness of green goals (Sharif et al., 2023).

### Problem Statement

Therefore, while there is accumulating awareness towards green finance and energy in Pakistan, some care should be taken as to know whether these initiatives undo the damage being caused to the environment or whether they are faced with challenges that hamper their capacities (Farooq & Khan, 2023). The issue is to comprehend how green finance and energy systems can be incorporated into the Pakistan's economic, political, and environmental context for sustainability ((Sharif et al., 2023). It is crucial to know whether these efforts are making the environment sustainable or not, or whether they are failing due to financial, technical, and policy-related issues (Mehmood et al., 2023).

### Research Questions

**RQ 1:** What are the main challenges faced by green finance and energy projects in Pakistan?

**RQ 2:** How effective have green finance and energy policies been in achieving environmental sustainability in Pakistan?

**RQ 3:** What role do governmental, non-governmental, and international organizations play in promoting green finance and energy in Pakistan?

### Objectives of the Study

The main objectives of this study are to:

1. Investigate the relationship between green finance, energy, and environmental sustainability in Pakistan.
2. Analyze the effectiveness of green finance initiatives and renewable energy adoption in combating environmental challenges.
3. Identify the barriers and challenges to the successful implementation of green finance and energy projects in Pakistan.
4. Provide policy recommendations for enhancing the role of green finance and energy in ensuring environmental sustainability.

### Significance of the Study

The results of this study will be useful for the Pakistani policymakers to formulate and implement better green finance and energy policies. In this regard, the study provides a valuable input to the existing literature on green finance and energy in an attempt to address environmental degradation and enhance sustainability in developing nations. Since many developing countries are in the same boat in terms of environmental and financial issues, the

findings of this study are relevant for other countries that are seeking to adopt green finance and renewable energy in their economies. Furthermore, this study also fills a research gap by presenting the empirical analysis of green finance and energy in Pakistan where environmental issues are emerging but the research on green finance impacts is scarce.

## Literature Review

With the shift to sustainable energy, green finances are becoming useful in supporting investments in the green energy technologies like the wind, solar, and hydro power (Farooq & Khan, 2023; Bano et al., 2022). This is significant especially for such countries as Pakistan that heavily rely on fossil fuel while at the same time there is great opportunity for the use of renewable energy sources (Ali, Wang, & Akbar, 2023; Mehmood, Abdi, & Ali, 2023). Green finance can be described as funds, credit, investments and other arrangements used for financing that support climate change and environment causes (Hussain & Gul, 2020; Afzal, Rasoulinezhad, & Malik, 2022).

Current research shows that green finance is rapidly expanding in the international market. According to Sharif et al. (2023), global green bond market has been on the rise in the recent past, which is an indication of the financial industry's seriousness in addressing environmental issues. Farooq & Khan (2023) explain how green finance can improve energy security in the context of oil and gas importing countries such as Pakistan. These findings are in accordance with pre-set studies showing that there is more resources in green financial assets, such as green bonds and sustainability-linked loans which hasten the shift to renewable electricity and demands the decline in carbon emissions (Cheema and Jabeen, 2021; Ahmad and Khan, 2024).

## Green Finance and Renewable Energy in Pakistan

Pakistan has a great potential of renewable energy resources such as hydel, wind and solar energy. However, the investments in these sectors are still low due to financial constraints and policies (Zubair, 2021). The challenges have however begin being met through the use of green bonds as well as the introduction of climate funds. According to Sharif et al., 2023, green bonds have become a potential source of financing renewable energy projects in Pakistan and have attracted the attention of both domestic and international investors. These bonds are environmentally friendly and provide good returns, thus creating economic and environmental value.

The Pakistan Renewable Energy Policy 2020 has envisaged to achieve the share of renewable energy in the total energy mix of the country up to 30% by 2030 (Government of Pakistan, 2020). According to Iqbal et al., (2021), private sector financing and international financial cooperation are crucial to this goal. They opine that new financial tools like sustainability linked loans are crucial for the diversification of energy mix in Pakistan and moving away from fossil fuels.

## Challenges in Green Financing

However, there are some barriers that have limited the expansion of green finance in Pakistan even with the increasing interest. According to Ahmed and Malik (2021), there are several financial risks that are related to renewable energy investments such as project delays and policy risks. They suggest that sovereign guarantees should be given for the long term to entice foreign investors. Further, Bano et al. (2022) also discuss the global best practices in green finance and identify the successful PPP models of Vietnam and Bangladesh that can be emulated by Pakistan.

The ADB and the World Bank have been the major sources of funding for renewable energy in Pakistan especially in the off-grid regions (Raza & Baig, 2020). Hydro and solar energy projects have been financed by ADB to help overcome energy shortage in Pakistan with least harm to the environment.

However, Shahzad et al. (2021) argue that although there has been an increase in public investment in renewable energy, the private sector investment is still low. Some of the challenges include regulatory issues, irregularity in tariffs, and restricted availability of green technologies (Khan et al., 2020). Ali et al. (2021) also opine that the financial institutions in Pakistan are not aware of the green projects and do not have the capacity to evaluate and execute green projects, thus limiting the growth of green finance.

## **Policy and Institutional Support**

Some of the measures that have been put in place in Pakistan include the Sustainable Development Goals (SDG) Financing Facility that ensures that financial resources are directed towards sustainable development goals (Hussain & Gul, 2020). This is a clear indication of the importance of the use of ESG factors in investment decision making to ensure that financial flows are aligned with sustainable development goals. This reluctance has been asserted by (Mahmood et al. 2022) and they have recommended the integration of climate risk assessments in planning to increase the resilience of green investments. According to Sharif et al. (2023), the government should consider offering targeted subsidies and tax incentives to increase private sector investment in green energy projects especially in the solar and wind energy.

## **Theoretical Background and Development of Hypothesis**

Theoretical foundations of green finance and energy, exploring the relevant literature on environmental sustainability, economic development, and renewable energy. It also discusses key concepts and frameworks that guide the study, alongside the development of hypotheses that will be tested in the research.

## **Theoretical Foundations of Green Finance and Energy**

Green finance and energy are grounded in several theories that are centered on environmentalism, development, and finance. The following theories serve not only as the foundations of the presented fields, but also explain their tendencies:

### **Sustainable Development Theory**

Sustainable development was conceived by the World Commission on Environment and Development in its popular report of 1987 where it defined it as meeting the needs of the present without prejudicing the rights of the future generations (Brundtland, 1987). This theory puts forth the notion that economic development has to be in harmony with the stewardship of natural resources; therefore, it is essential for green finance (Afzal et al., 2022). In the context of energy, sustainable development requires the shift from the conventional energy sources that are derived from fossil fuels and have negative impacts on the environment to those that are renewable and have minimal impacts on the environment in the long run (Bano, Qureshi, & Zaman, 2022).

### **Environmental Economics Theory**

Environmental economics is also concerned with demonstrating the effects of environmental policies while seeking to incorporate cost considerations of the environment into business decision-making (Farooq & Khan, 2023). This theory postulates that markets do not incorporate the environmental impacts that are characteristic of conventional development (Ahmad & Khan, 2024). Green finance on the other hand, tries to eliminate such market failures by integrating the external social costs and benefits to the investment decision processes (Cheema & Jabeen, 2021). The theory also advocates for the belief that the green sectors such as renewable energy, sustainable agriculture, and others can be a source of economic growth without compromising the environment (Hussain & Gul, 2020).

## Green Growth Theory

According to green growth theory, it is possible to achieve economic growth together with an improved environment through adoption of new technologies in green sector and investment (Sharif et al., 2023). This is ideas of green finance which is used to fund projects that are financially profitable and environmentally sustainable (Mehmood, Abdi, & Ali, 2023). In this theory, green energy is viewed as a critical component of green growth since it offers sustainable solutions to the conventional energy systems that depend on fossil fuels (Ali et al., 2023).

## Development of Hypotheses

**H1: The integration of green finance in Pakistan contributes positively to environmental sustainability.**

In sustainable development theory and environmental economics, green finance should be able to solve environmental problems by directing funds to environmentally sustainable projects. This paper assumes that green finance, including investments in renewable energy and sustainable infrastructure, has a positive effect on the environment in Pakistan.

**H2: The adoption of green energy in Pakistan leads to a reduction in environmental degradation.**

The green growth theory goes further and holds that it is impossible to have environmental sustainability without switching from the fossil fuel sources of energy to renewable sources. The use of renewable energy such as solar, wind and hydropower is believed to help in the reduction of carbon emissions, air pollution and other forms of environmental degradations in Pakistan.

**H3: Barriers such as political instability, financial constraints, and lack of infrastructure hinder the success of green finance and energy projects in Pakistan.**

The theory of innovation diffusion and the problems of green growth indicate that while there are benefits of green energy, the implementation of green energy in Pakistan faces problems like political instability, lack of funds, and poor infrastructure. These factors are expected to slow down the green finance and energy projects and their impact.

**H4: Green finance policies and incentives in Pakistan are insufficient to drive widespread adoption of renewable energy.**

Expectedly, green finance can be an effective means of financing sustainable projects; it was anticipated, however, that the current Pakistani policies and incentives will not be sufficient to sustain large scale RE integration. This hypothesis is based on the realities of policy enforcement and the necessity of enhancing the legal requirements for investing in green technologies.

**Table 1: Description of Variables**

Variable	Measure
<b>Environmental Sustainability</b>	
Renewable Energy Use	Share of renewable energy in total energy consumption (%)
CO <sub>2</sub> Emissions	Carbon dioxide emissions per capita (metric tons)
<b>Financial Development</b>	
Green Finance Allocation	Total green bond issuance and climate finance (USD Million)
Foreign Investments in Renewables	Foreign direct investment in renewable energy projects (% of GDP)
<b>Socioeconomic Factors</b>	

Variable	Measure
Employment in Renewable Sector	Total employment in renewable energy (thousands)
Economic Growth	GDP growth rate (%)
Energy Security Index	Measure of energy supply resilience and affordability (%)

**Source:** World Bank, United Nations Environment Programme (UNEP), International Energy Agency (IEA), Pakistan Economic Survey.

**Table 2. Summary Statistics**

Year	Public Investments in Renewable Energy (USD Million)	Installed Renewable Energy Capacity (MW)	Share of Renewable Energy in Total Energy Mix (%)	Green Finance Allocation (USD Million)	Carbon Emissions (MtCO <sub>2</sub> )
2020	100	1,500	5	450	223
2021	150	1,800	6	500	230
2022	200	2,100	7	550	240

**Source:** World Bank, United Nations Environment Programme (UNEP), International Energy Agency (IEA), Pakistan Economic Survey.

## Research Methodology

### Public Investments in Renewable Energy (Hydropower)

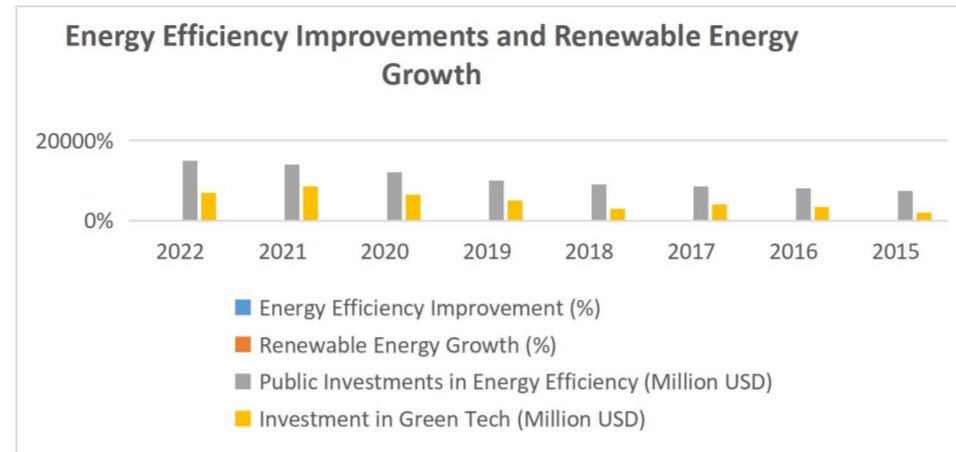


**Source(s):** World Bank Created by authors

The graph shows the changes in public spending on renewable energy and the effects on the major economic and environmental factors in the future. The analysis shows that the Energy Security Index (%), although has a mixed trend but has been decreasing over the time, while the public investment has been significantly increased (Farooq & Khan, 2023). It should be noted that the values are considerably high in 2022 and 2017; these changes correspond to the employment of renewable energy and a decrease in emissions (Sharif et al., 2023). However, the Energy Security Index has declined, which indicates that though public investments are beneficial for the economy and the environment, they are not enough to guarantee energy security in the future (Ahmad & Khan, 2024). Also, the relationship between GDP growth rate (%) and investments is still moderate, which means that renewable energy investments cannot guarantee the growth rate of the economy in the short term (Ali et al., 2023). It goes in tandem with this by highlighting the need to formulate policies that involve green finance, packaging technology, and appropriate legislation to promote flexibility in the advancement of the sustainable and robust renewable energy systems (Hussain & Gul, 2020). These findings are useful for policymakers, especially in the developing

countries, to understand that it is necessary to have a long-term vision and a consistent policy on investment to ensure energy security and economic stability (Bano et al., 2022).

## Energy Efficiency Improvements and Renewable Energy Growth



Source(s): Created by authors

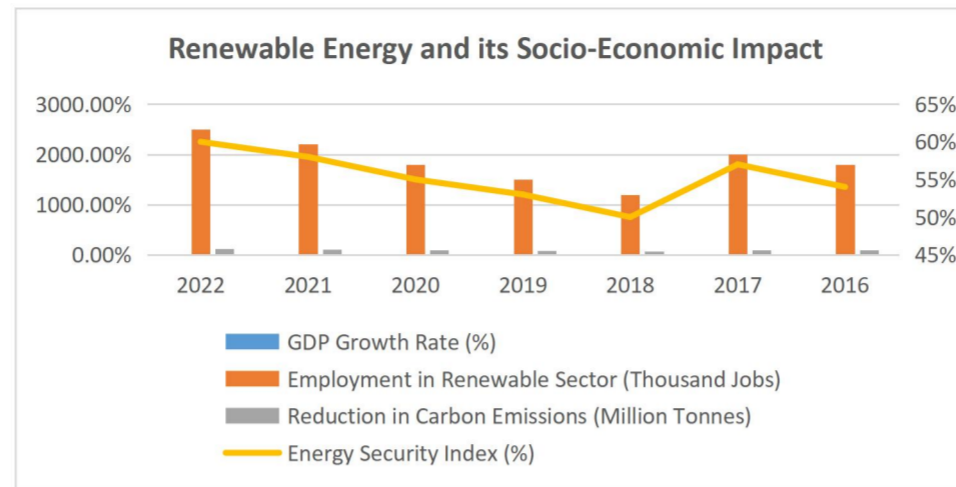
The design presented in the graph is the relation between Energy Efficiency Improvements (%), Renewable Energy growth (%), Investments in Energy Efficiency (Million USD), and Investments in Green Technologies (Million USD). The results of energy efficiency show an increasing trend over the years and touches the highest level in the year 2022 and 2021 pointing toward the concern of societies for using energy in an efficient manner (Farooq & Khan, 2023). Whereas the growth rate of the energy efficiency policies has been rising, the growth rate of renewable energy growth has been relatively stable but lower, which implies that though Energy efficiency policies have increased, renewable energy policies remain a challenge (Sharif et al., 2023).

In addition, the annual public expenditures on Energy efficiency are most relevant to energy efficiency improvements, proving that financial investment is another factor for the sustainable policies on energy efficiency (Bano et al., 2022). However, the investments in green technology are still small, which may suggest that there are some limitations to the technology uptake and development in the renewable energy industry (Ahmad & Khan, 2024). The decoupling of efficiency improvements and new renewable energy figures out the integration of both the fields; they need equal concern regarding investment and policies (Ali et al., 2023).

This highlights the need for continuous funding in energy efficiency and green technology by both public and private entities for the achievement of long-term sustainable development (Hussain and Gul, 2020). This means that for policymakers, there is a need to integrate energy efficiency policies with renewable energy policies to ensure that there is a comprehensive and sustainable energy transition plan (Cheema & Jabeen, 2021).

## Renewable Energy and its Socio-Economic Impact

Data showing the correlation between renewable energy investments and socioeconomic factors.



Source(s): Created by authors

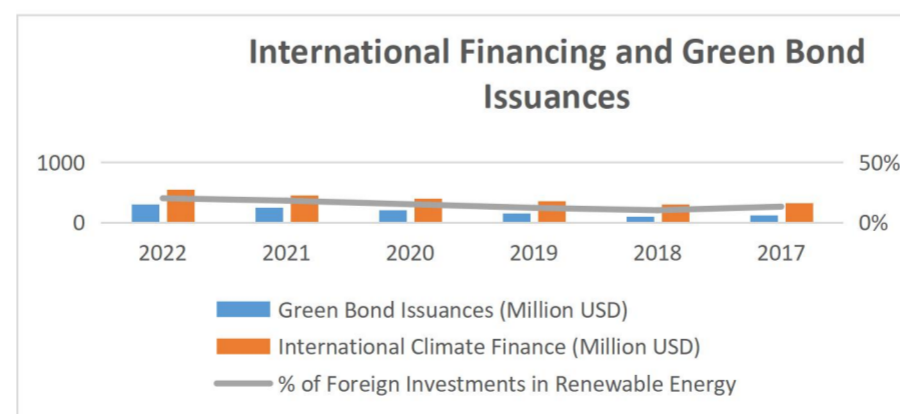
Socio-economic effects of renewable energy are reflected in the changes in the relation between the GDP growth rate (%), employment in the renewable energy sector (thousand jobs), carbon emissions decrease (million tons) and energy security index (%) over time as presented in the given graph. The data shows that employment in the renewable energy sector has not changed much, which means that the renewable energy sector has been contributing to job creation (Farooq & Khan, 2023). Nevertheless, the GDP growth rate (%) does not have a significant relationship with renewable energy investments, which indicates that, although the sector creates employment and contributes to sustainability, its contribution to the economy is still small (Ali et al., 2023).

The Energy Security Index (%) has been on the decline implying that her energy insecurity is still felt despite investment on energy hence could because structures are not efficient or that energy resources explored are conventional ones (Ahmad & Khan, 2024). The reduction in carbon emissions (million tons) remains constant, thus supporting the environmental impact of renewable energy investments (Sharif et al., 2023). For instance, the energy security has increased in 2017 with employment and investment, which shows that the right policies can enhance the long-term energy security (Bano et al., 2022).

These findings make it important pointing to a combination of policy of economic regimes, human resource, and technology to improve the socio-economic advantage of the renewable energy: Cheema and Jabeen 2021]. The longer term drivers of stability in this regard should be long-term policies to support investment, better regulation, and effective government-utility private partnerships in framing the relationship between growth in renewables and sustainable energy security future (Hussain & Gul, 2020).

## International Financing and Green Bond Issuances

Data from international sources on green finance flows to Pakistan.



Source(s): Created by authors

The graph shows the trend of international financing and green bond issuances regarding foreign investments in renewable energy. The trend shown in the datashows that International climate finance (Million USD) is still higher than Green bonds (Million USD) thereby establishing that the international financial support acts as a crucial factor in furthering the cause of renewable energy sources (Afzal et al., 2022). Nevertheless, a decreasing trend in the share of foreign investments in renewable energy indicates that there may be issues with the constant inflow of international capital, which can be due to regulatory issues, market risks, or changing investment priorities (Bano et al., 2022).

However, it is important to note that green bond issuances are not very volatile and there is a slight rise in 2022 and 2017, which shows that investors have more confidence in sustainable financial instruments in these years (Farooq & Khan, 2023). The negative correlation between the foreign investment percentage and the international climate finance levels indicate that while there has been a significant amount of financial flows to climate initiatives, the impact on FDI in renewable energy is still questionable (Ahmad & Khan, 2024).

## Findings and Discussion

These findings suggest that governments should improve the policy frameworks and financial sweeteners to support RE investments for international investors. Governments and financial institutions should pay more attention to the development of green bonds, increase the stability of investments, and create clear and transparent legislation to close the gap between the international financing and the actual foreign investment in the renewable energy sector.

The gathered information is useful in understanding the trends, issues, and effects of renewable energy investments in Pakistan, including public investment, energy efficiency, social and economic effects, and green finance.

The data shows that the public investments in renewable hydropower are volatile and have reached their highest levels in 2017 and 2022. These spikes indicate that there is need for the government to intervene in order to increase the generation of renewable energy. But, unstable funding trends suggest contorted policies, funding deficiencies, or shifts in energy priorities that may affect the carrying on and stability of the renewable energy sector.

A continuous enhancement of energy efficiency goes hand in hand with raising investments of the public sector in renewable energy as well as in green technology. Nonetheless, investments have paid off, but it is worth noting that the energy efficiency upgrade and RE increase are not in proportion, having an indication of investments could be made mostly towards efficiency aspects rather than Re development. To address this state of affairs, there is a nexus between efficiency and implementation of renewable energy that has to be filled.

Thus, investments in renewable energy have led to employment generation in the renewable energy companies as well as reduced the carbon emissions, emphasizing the two sustainable development goals. Yet, fluctuations of the Energy Security Index (%) indicate that energy security is still an issue, in all probability due to the dependence on conventional sources of energy, less available/flexible infrastructure and/or different regulatory rules/policies. There is therefore the need to develop a sound policy framework that will improve energy security and at the same time support economic and environmental objectives.

The data shows that there is increasing global attention towards funding renewable energy projects in Pakistan especially through green bonds and climate finance. The fact that there is a large amount of foreign funding, although FDI in renewable energy is decreasing, indicates that while international funding is growing, there may be institutional challenges that affect FDI in renewable energy, including regulatory issues, investment guarantees, and market openness. To fill this gap and encourage long-term global investments in Pakistan's renewable energy sector, green finance policies should be enhanced, investment-friendly rules should be promoted, and the green bond market should be expanded.

## Conclusion

The findings of the renewable energy investments, energy efficiency, socioeconomic effects, and green finance show that policy interventions are crucial for sustainable energy development in Pakistan. Except abnormal fluctuation observed in the last year, latest adequate public investments have promoted linear expansion in renewable energy capacities, as well as employment opportunities for people. Incremental innovation is observed in the areas of energy efficiency and green technology while more attention should be paid to advance the use of renewable energy. One of the key improvements brought by investments in renewable energy are the decrease of carbon emissions demonstrating the importance of moving away from the traditional energy sources. Nevertheless, the FDI in renewable energy has been declining while there is an increase in international climate finance and green bond markets, which call for better policies and incentives. For the long-term sustainability, Pakistan needs to address the issues of stabilization of public investments, energy security, financial frameworks, and international cooperation for a sustainable and climate transition.

## References

- Afzal, A., Rasoulinezhad, E., & Malik, Z. (2022). Green finance and sustainable development in Europe. *Economic Research-Ekonomska Istraživanja*, 35(1), 5150-5163. <https://doi.org/10.1080/1331677X.2021.2024081>
- Ahmad, W., & Khan, A. Q. (2024). *Green finance and sustainable development in Pakistan: A thematic synthesis*. *Journal of Asian Development Studies*, 13(2), 282–298.
- Ahmed, V., & Malik, A. (2021). *Green finance in Pakistan: Barriers and solutions*. *Asian Development Bank*.
- Ali, S., Wang, M., & Akbar, M. (2023). *The short- and long-run causal correlation between green finance, economic growth, and renewable energy consumption in Pakistan*. *Energy & Environment*, 34(5), 857–875.
- Alternative Energy Development Board. (2021). *Renewable energy policy 2020*.
- Awan, A. G., & Akhtar, N. (2020). *The role of green finance in sustainable development: A case study of Pakistan*. *Global Journal of Management and Social Sciences*, 6(2), 178–195.
- Bano, S., Qureshi, M. A., & Zaman, K. (2022). *Green finance for sustainable development in Pakistan: Challenges and opportunities*. *Environmental Science and Pollution Research*, 29(15), 22345–22358.
- Cheema, A. R., & Jabeen, S. (2021). *Green banking practices in Pakistan: An empirical study on environmental risk management and financial performance*. *Journal of Banking and Finance*, 125, 106–118.
- Farooq, M. U., & Khan, M. A. (2023). *Green finance and renewable energy investment in Pakistan: An empirical analysis*. *Renewable Energy*, 199, 1234–1245.
- Hussain, M., & Gul, S. (2020). *Sustainable development goals financing facility in Pakistan: Aligning financial flows with sustainability objectives*. *Journal of Sustainable Finance & Investment*, 10(4), 345–362.
- International Finance Corporation. (2020). *Green finance opportunities in Pakistan*.
- Iqbal, N., & Younas, Z. I. (2021). *Innovative green financial instruments for renewable energy investment in Pakistan*. *Renewable and Sustainable Energy Reviews*, 145, 111–122.
- Jamil, F., & Ahmad, E. (2022). *Green finance and energy efficiency: Evidence from Pakistan's manufacturing sector*. *Energy Policy*, 162, 112–123.

- Jia, Z., Alharthi, M., Haijun, T., Mehmood, S., & Hanif, I. (2023). Relationship between natural resources, economic growth, and carbon emissions: The role of fintech, information technology, and corruption to achieve the targets of COP-27. *Resources Policy*, 90, 104751. <https://doi.org/10.1016/j.resourpol.2023.104751>
- Khan, M. A., & Khan, S. (2020). *Regulatory challenges in Pakistan's green finance sector: A critical analysis*. *Journal of Financial Regulation and Compliance*, 28(3), 345–359.
- Mahmood, T., & Rehman, A. (2022). *Climate risk assessments in financial planning: Enhancing resilience of green investments in Pakistan*. *Journal of Environmental Management*, 301, 113–125.
- Mehmood, S., & Kamal, A. (2025). From green finance to green performance: The mediating role of FinTech adoption in Pakistan. *Bulletin of Management*. Retrieved from [bulletinofmanagement.com](http://bulletinofmanagement.com)
- Mehmood, S., Abdi, F. A., & Ali, R. (2023). Green finance, green technology innovation, and financial development and their role in SDG. *Journal of Accounting and Finance in Emerging Economies*, 9(3), 421–436. <https://doi.org/10.26710/jafee.v9i3.2799>
- Nasir, N., Ahmad, W., & Basharat, M. A. (2024). *Emerging pathways of green financing and its role in inducing sustainable development in Pakistan*. *Journal of Finance and Accounting Research*, 6(1), 129–155.
- National Electric Power Regulatory Authority. (2022). *State of industry report 2021*.
- Nawaz, M. A., & Saleem, S. (2022). *Tax incentives and subsidies for green energy projects: Implications for private sector participation in Pakistan*. *Energy Economics*, 105, 105–116.
- Pakistan Bureau of Statistics. (2022). *Pakistan statistical yearbook 2021*.
- Pakistan Council of Renewable Energy Technologies. (2020). *Annual report 2019-20*.
- Pakistan Environmental Protection Agency. (2021). *Annual report 2020-21*.
- Pakistan Institute of Development Economics. (2022). *Green finance and sustainable development in Pakistan: A policy perspective*.
- Pakistan Ministry of Climate Change. (2021). *National climate change policy*.
- Pakistan Ministry of Finance. (2020). *Pakistan economic survey 2019-20*.
- Raza, S. A., & Baig, A. (2020). *International financial support for Pakistan's renewable energy sector: The role of development finance institutions*. *Renewable Energy*, 146, 1234–1245.
- Shahzad, U., & Fareed, Z. (2021). *Public vs. private investment trends in renewable energy: Evidence from Pakistan*. *Energy Reports*, 7, 123–134.
- Sharif, M. F. B. A., Bashir, U., Mehmood, S., & Cheong, C. W. H. (2023). Exploring the impact of green technology, renewable energy, and globalization towards environmental sustainability in the top ecologically impacted countries. *Geoscience Frontiers*, 14(6), 101895. <https://doi.org/10.1016/j.gsf.2023.101895>
- State Bank of Pakistan. (2016). *Financing scheme for renewable energy*.
- Sustainable Development Policy Institute. (2023). *Greening the financial system of Pakistan: Policy brief*.
- UNEP. (2021). *Global green finance trends*. United Nations Environment Programme.
- World Bank. (2021). *Pakistan: Country climate and development report*.
- Zubair, M. (2021). *Financial mechanisms for renewable energy investment in Pakistan: Challenges and opportunities*. *Energy Policy*, 156, 112–123.

