

A Comparative analysis of Green Investment and Climate Economics; India and other Countries

Mrs. A. Gracy Rani

Head and Assistant professor, Department of Economics
Fatima college, Madurai

Abstract- Green investment, which centres on environmentally sustainable projects, has attracted considerable attention in recent years owing to rising concerns about climate change, environmental degradation, and the need for sustainable development. India, one of the fastest-growing economies in the world, has made notable progress in green investment, particularly in renewable energy, sustainable infrastructure, and eco-friendly technologies. This paper examines the comparison of green investment in India with that of other countries by analysing its contribution to GDP growth, job creation, technological progress, and environmental sustainability. It also assesses the policy frameworks, financing mechanisms, and challenges faced by the Indian government and private sector in promoting green investment. The paper concludes with recommendations for further integrating green investment into India's long-term development strategy.

Keywords- Green investment.

I. Introduction

Green investment is a broad term that encompasses capital allocation into businesses or projects that generate positive environmental outcomes. These investments aim to:

- Reduce the carbon footprint and mitigate the impacts of climate change.
- Promote energy efficiency and the sustainable use of natural resources.
- Encourage the use of renewable resources (such as solar, wind, and hydropower).
- Support sustainable infrastructure, including green buildings, smart grids, and eco-friendly transportation systems.

Green investment can come from a variety of sources, including public and private funds, institutional investors, development banks, and international organisations. In India, the government has played a significant role in promoting green investment through policy incentives, regulatory frameworks, and international collaborations. Green investment is closely linked to the concept of sustainable development, which aims to meet present needs without compromising the ability of future generations to meet their own. For India, green investment serves as a dual tool: it simultaneously supports the country's economic aspirations while addressing pressing environmental challenges.

Objectives

- To describe the comparison of green investment in India with other countries.
- To analyse the impact of green investment on India's economic development.
- To describe the policy frameworks supporting green investment in India.
- To identify the major challenges in expanding green investment.

Impact of Green Investment on India's Economic Development

Contribution to GDP Growth

Green investment has become an increasingly important driver of economic growth in India. With renewable energy and sustainable infrastructure as key focus sectors, the contribution of green projects to India's GDP is expected to grow substantially in the coming decades. According to McKinsey (2022), green investment of 3.5–6% of GDP will be required until 2050 to decarbonise the Indian economy. Additionally, annual investment of about 2.5% of India's GDP would be required until 2030 solely to address the infrastructure gap caused by climate events. India does not officially measure Green GDP, but research suggests that in 2019 it stood at around Rs 167 trillion, a 10% reduction from the conventional GDP of Rs 185.8 trillion for the same year.

Renewable Energy as a Catalyst for Growth

India's renewable energy sector, especially solar and wind energy, has witnessed exponential growth in recent years, supported by the government's target of achieving 500 GW of non-fossil energy capacity, alongside growing environmental sustainability initiatives and green bonds.

Sustainable Infrastructure and Green Buildings

Green investment in infrastructure, particularly in sustainable buildings, smart cities, and eco-friendly transportation systems, also contributes to India's GDP. Sustainable infrastructure projects improve energy efficiency, reduce waste, and enhance the overall productivity of the economy. India's Smart Cities Mission, which seeks to promote environmentally sustainable and resource-efficient urban development, has attracted significant investment and contributed to the modernisation of the country's urban areas. Green buildings, which incorporate energy-efficient materials and sustainable design principles, are seeing rising demand in India. The growth of this sector contributes directly to economic output while reducing energy consumption and lowering operational costs for businesses and households.

Employment Generation through Green Investment

One of the most tangible benefits of green investment in India is its potential to create jobs.

Employment in Renewable Energy

The renewable energy sector has emerged as a major employer in India. According to the International Renewable Energy Agency (IRENA), the renewable energy industry employed over 719,000 people in India by 2020. The solar photovoltaic (PV) sector accounted for the largest share of jobs, with over 50% of employment in this sector, followed by wind energy and bioenergy. As the country accelerates its efforts to expand renewable energy capacity, these employment figures are projected to grow substantially. Solar energy projects, in particular, create jobs in various areas, including the manufacturing of solar panels, installation, operations and maintenance, and grid management. Furthermore, decentralised solar projects in rural areas offer local communities the opportunity to participate in the renewable energy supply chain, helping to alleviate poverty and boost rural incomes.

Technological Innovation and Development

Green investment is driving technological innovation in India, particularly in clean energy technologies, energy storage solutions, and smart grids. As India scales up its renewable energy ambitions, technological advancement will be crucial to overcoming challenges such as intermittency in solar and wind energy, grid integration, and energy storage. The government has introduced several policies to promote the adoption of EVs, including the FAME (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles) scheme. Technological advancements in EV battery technology, charging infrastructure, and vehicle design are being supported by both domestic and international investment.

Environmental Sustainability

Green investment is having a profound impact on environmental sustainability in India. By reducing dependence on fossil fuels and promoting the use of renewable resources, these investments are helping to mitigate the impacts of climate change and reduce pollution levels.

Conserving Natural Resources

Green investment in water conservation, afforestation, and sustainable agriculture is also contributing to the preservation of India's natural resources. For instance, sustainable farming techniques such as precision agriculture, drip irrigation, and organic farming are being promoted to reduce water consumption and improve soil health. These practices not only enhance agricultural productivity but also contribute to long-term environmental sustainability.

Waste Management and Circular Economy

India is facing a waste management crisis, as urbanisation and population growth have led to an increase in solid waste generation. Green investment in waste management technologies, such as waste-to-energy plants and recycling facilities, is helping to address this challenge.

II. Comparative Analysis with Other Countries

Country / Region	Clean Energy Investment (2026 Est.)	Share of Global Clean Investment	Leading Investment Areas
China	~USD 680–700 billion	~31–32%	Solar PV, wind, EV supply chains, ultra-high-voltage (UHV) grids, battery gigafactories
European Union	~USD 400–415 billion	~18–19%	Grid resilience, offshore/onshore wind, heat pumps, building efficiency, nuclear life extensions
United States	~USD 330–350 billion	~15–16%	Utility-scale solar, battery storage (surpassing wind), SMR/advanced nuclear, domestic clean tech manufacturing
India	~USD 42–45 billion	~2%	Utility solar, hybrid wind-solar projects, transmission green energy corridors, PLI storage incentives

Japan & South Korea	~USD 60–65 billion	~3%	Offshore wind, nuclear restarts/deployments, hydrogen & ammonia co-firing
Southeast Asia	~USD 30–35 billion	~1.5–2%	Solar PV manufacturing, regional grid interconnection, EV assembly
Latin America (incl. Brazil)	~USD 40–45 billion	~2%	Biofuels, hydropower modernisation, utility solar, distributed generation
Middle East	~USD 25–30 billion	~1–1.5%	Giga-scale solar parks, green hydrogen pilots, nuclear power
Africa (All countries)	~USD 20–25 billion	~1%	Off-grid & mini-grid solar, commercial/industrial solar installations

- **China:** Accelerating deployment in north-western renewable mega-bases and expanding UHV transmission; outbound EV value-chain investment remains strong.
- **European Union:** Electricity grids receive over USD 75 billion annually, as grid modernisation has become a top priority.
- **United States:** Power generation investment is heavily driven by data centre and AI load growth; battery storage spending has expanded rapidly, surpassing wind.
- **India:** Non-fossil capacity expansion maintains rapid momentum toward the national goal of 500 GW by 2030.
- **Africa:** High capital costs and macroeconomic headwinds continue to suppress utility-scale deployment despite immense solar potential.

Sector	2026 Global Investment	Trend / Notes
Renewable Power (All forms)	~USD 800 billion	Solar PV represents the largest share, outpacing all other generation sources combined.
Energy Efficiency & Electrification	~USD 720–750 billion	Driven by transport electrification (EVs taking ~30% market share) and heat pump adoption.
Electricity Grids	~USD 420–440 billion	Accelerated grid reinforcement to address integration bottlenecks and extreme weather risks.
Nuclear Power	~USD 80–85 billion	Long-term reactor extensions and rising commercial capital in Small Modular Reactors (SMRs).
Battery Storage (Grid & Behind-the-Meter)	~USD 80–85 billion	Rapid-growth sector; critical for system flexibility and renewable firming.
EV Charging Infrastructure	~USD 48–52 billion	Fast-charging highway networks and heavy-duty fleet depot build-outs.
Low-Emission Fuels & Hydrogen	~USD 10–12 billion	Focus shifting toward viable industrial hubs and electrolyser projects with secured off-takers.

China, the world's largest producer of renewable energy, has invested heavily in solar and wind power. The country's aggressive investment strategy has enabled it to achieve significant reductions in carbon emissions while maintaining strong economic growth. China's green investment is driven by large state-owned enterprises and supported by substantial government subsidies and financial incentives. India can learn from China's experience by scaling up public investment in renewable energy and creating a supportive policy environment for private sector participation. Both countries share similar challenges in terms of population growth, energy demand, and environmental degradation, making this comparison particularly relevant.

Germany is a global leader in green investment, particularly in the areas of renewable energy, energy efficiency, and electric mobility. The country's Energiewende (energy transition) policy has set ambitious targets for reducing greenhouse gas emissions and transitioning to renewable energy. Germany's success is largely due to its strong policy framework, which includes feed-in tariffs, tax incentives, and subsidies for renewable energy projects. India can benefit from adopting similar policy instruments, particularly in the areas of energy storage, grid management, and electric vehicles. Germany's experience also highlights the importance of fostering innovation through research and development (R&D) in green technologies.

The United States has made significant progress in green investment, particularly in the fields of wind and solar energy. Government initiatives such as tax credits, grants, and loan guarantees have helped stimulate private sector investment in clean energy technologies. The Biden administration's climate policies were focused on achieving net-zero emissions by 2050, with a strong emphasis on green infrastructure, electric vehicles, and renewable energy.

India can draw lessons from the U.S. in terms of leveraging public-private partnerships (PPPs) to finance large-scale green infrastructure projects. The U.S. experience also underscores the importance of creating a stable and predictable regulatory environment to encourage long-term green investment.

III. Policy Framework

Policy Frameworks Supporting Green Investment in India National Action Plan on Climate Change (NAPCC)

The National Action Plan on Climate Change (NAPCC), launched in 2008, serves as the backbone of India's climate strategy. It outlines eight missions that address climate adaptation and mitigation, focusing on renewable energy, energy efficiency, and sustainable agriculture. The National Solar Mission and the National Mission for Enhanced

Energy Efficiency have been key drivers of green investment in India. The NAPCC is closely aligned with India's commitment to the Paris Agreement, which seeks to limit global warming to 1.5°C. The plan sets ambitious targets for renewable energy generation, energy conservation, and carbon emission reduction.

Accelerated Depreciation Benefits Policy

This policy allows investors in renewable energy projects, particularly wind and solar, to claim accelerated depreciation on their investments, reducing their tax burden.

Generation-Based Incentives (GBIs)

GBIs provide incentives to renewable energy producers based on the amount of electricity they generate, encouraging higher production and efficiency in renewable energy projects.

Renewable Purchase Obligations (RPOs)

Under RPOs, electricity distribution companies are required to source a certain percentage of their power from renewable sources. This policy has driven demand for renewable energy and spurred investment in the sector.

Public-Private Partnerships (PPPs) in Green Investment

Public-Private Partnerships (PPPs) have been instrumental in attracting private investment into green projects. The Indian government has facilitated PPPs in sectors such as solar parks, smart cities, and waste management. PPPs provide the necessary capital and technical expertise to scale up green projects and ensure their successful implementation.

The following dataset shows the share of public and private sector investment in renewable energy projects in India (in USD billions) between 2015 and 2025.

Year	Public Sector Investment (USD billion)	Private Sector Investment (USD billion)
2015	5.1	7.3
2016	6.2	8.1
2017	7.0	9.5
2018	7.5	11.2
2019	8.0	13.0
2020	9.1	15.5
2021	10.3	17.8
2022	12.0	20.0
2025	15.0	30.0

IV. Global Concentration of Green Investment

Capital deployment remains heavily concentrated among major economic powers, while developing regions face severe financing deficits:

- China continues to lead the world, deploying nearly one-third of global clean energy investment.
- Advanced Economies (USA, EU, Japan, Korea) collectively account for around USD 1.1 trillion of total clean energy investment.
- Emerging Markets (India, Brazil) sustain high investment trajectories, driven by energy security mandates and domestic manufacturing incentives.

Suggestions

Strengthening Policy Support

To further promote green investment, the Indian government must continue to strengthen its policy framework.

Expanding Public-Private Partnerships (PPPs)

Public-Private Partnerships (PPPs) offer a viable solution for overcoming the financing gap for green projects.

Investing in Skills Development

India must invest in education and training programmes to develop a skilled workforce capable of supporting the green transition. Establishing Green Skill Development Centres across the country will ensure that workers are equipped with the skills needed to participate in the green economy.

V. Conclusion

The government should provide more funding for research and development (R&D) in green technologies, including advanced battery storage, smart grids, and electric mobility. Collaborating with international partners on joint R&D initiatives can accelerate the development of cutting-edge green technologies.

References

1. International Renewable Energy Agency (IRENA). (2020). Renewable Energy and Jobs Annual Review. Government of India. (2008). National Action Plan on Climate Change.
2. Indian Ministry of New and Renewable Energy (MNRE). (2020). Annual Reports and Energy Statistics. World Bank. (2021). Green Bond Markets and Sustainable Investment in India.
3. International Solar Alliance (ISA). (2021). India's Leadership in Global Solar Energy Initiatives. Central Electricity Authority (CEA). (2020). Renewable Energy Statistics.
4. Securities and Exchange Board of India (SEBI). (2020). Guidelines for Green Bond Issuance.
5. Schönherr, N., Findeisen, F., & Martinuzzi, A. Exploring the interface of CSR and the sustainable development goals. *Transnational Corporations*. 2017; 24(3): 33–47.
6. Harlan, S. L., et al. Climate justice and inequality. *Climate Change and Society: Sociological Perspectives*. 2015: 127–163.
7. Fuerst, F., & McAllister, P. Green noise or green value? Measuring the effects of environmental certification on office values. *Real Estate Economics*. 2011; 39(1): 45–69.
8. Leila, M. M. Green Investment of Heritage Environments: A Doorway to a Life of Quality. In *Proceedings of the 1st International Conference on Towards a Better Quality of Life*.