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Renewable Energy Financing In India: Role Of IREDA And REC Ltd

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Abstract: Energy production and consumption are crucial for nations aiming for economic growth, but they also lead to significant environmental damage. India, in its transitioning phase from fossil to cleaner energy sources, faces the dual challenge of meeting rising energy demands while addressing climate change. This paper examines how green finance can facilitate the transition to clean energy in India. It highlights the importance of green finance in fostering sustainable development and assesses the current financial landscape supporting renewable energy initiatives. The focus is on government initiatives, loan portfolios, and the fund contributions from IREDA and REC Ltd. A descriptive and qualitative approach is employed to underscore finance as essential to business. Additionally, it reflects the financing patterns of these institutions, including their loan sanctions, loan disbursements, and issuance of green bonds to support clean energy in India.

Keywords: Green finance, IREDA, Renewable energy sources, MNRE, REC ltd

I. INTRODUCTION

Addressing the concerns:

Traditionally, countries have been striving to achieve economic growth and balanced development in different sectors of the economy by focusing on various macroeconomic objectives. Countries aim to boost their GDP, a major macroeconomic objective, by increasing the production of goods and services and satisfying the needs of their citizens. The input used in the production includes the environmental resources, and the output produced is again disposed of in the environment. Just for the sake of increasing gross domestic product, the resources are being utilized at a faster rate. On one hand, there is increased production and exploitation of natural resources at a greater rate, and on the other hand, the excessive output produced along with its waste is dumped in the environment. Hence, the environment is harmed from both ends. Climate change, Resource depletion, and environmental degradation, such as air pollution, water pollution, and land pollution, as well as deforestation, are some major concerns of today. It is of extreme importance that, along with economic growth, environmental concerns should be well addressed. What is needed are small but consistent changes in the current modes of consumption and production. State intervention is required, but it shouldn't mean that the state becomes highly interventionist. Major changes through well-specified policies with clear strategies will be required, such as carbon pricing (Bowen & Hepburn, 2014). Collective actions will be required from the entire nation, including the public.

Energy security:

As per the IEA, India plays a significant role in the global energy market. Since the year 2000, energy consumption has more than doubled, driven by a rapidly growing population, soon to become the largest in the world, and a phase of vigorous economic expansion. By 2019, the country achieved near-universal access to electricity, resulting in over 900 million people obtaining electrical connections in less than twenty years. As India continues to industrialize and urbanize, the energy sector and policymakers will face substantial demands. On a per capita basis, energy consumption remains below half of the global average, with notable

disparities in energy usage and service quality across different states as well as between urban and rural regions. For consumers in India, the affordability and reliability of energy supply are crucial concerns. More than 80% of India's energy needs are met by three main fuels: coal, oil, and solid biomass. Coal has been fundamental to the growth of electricity production and industrial activities, and it continues to be the most significant fuel in the energy landscape. Oil consumption and imports have surged rapidly due to increased vehicle ownership and the growing use of road transport. Biomass, chiefly in the form of fuelwood, constitutes a decreasing portion of the energy mix, yet it is still commonly utilized as a cooking source. Although there has been recent progress in extending the availability of LPG in rural regions, 660 million Indians have not completely transitioned to modern, clean cooking fuels or technologies.

Emission levels:

According to NITI Aayog, Goal 13: Greenhouse gas emissions from human activities are a major cause of climate change and are continuously increasing. Compared to pre-industrial times, CO_2 concentrations have increased by 40%, mainly due to fossil fuel use and secondly due to net land use change emissions. The quality of oceans is also declining due to the absorption of about 30% of anthropogenic carbon dioxide emissions. Every decade over the past thirty years has been progressively warmer at Earth's surface compared to any previous decade since 1850. In the Northern Hemisphere, the period from 1983 to 2012 was probably the hottest 30-year span in the last 1,400 years. More importantly, the global temperature has increased by 0.85% from 1880 to 2012. The average global surface temperature is predicted to rise over the course of the twenty-first century and most likely reach three degrees Celsius if such a circumstance is further disregarded. There was a rise in the average global sea level of 0.19 meters between 1901 and 2010. Technological and behavioural changes may limit the rise in global mean temperature to 2 °C, i.e., above pre-industrial levels. India pledged to decrease the emissions intensity of its GDP by 20 to 25% by the year 2020, which may create economic, social, technological, financial, and institutional challenges. In such a grave situation, clean energy can play a critical role. Therefore, countries have started promoting renewable energy. Many studies have also suggested that renewable energy can not only power the cities but may also reduce GHG emissions, foster sustainable growth, and reduce environmental harm.

The role of Finance

Although India’s efforts in the direction of sustainability and the renewable energy sector in the last decade are commendable, it will consistently require funds for a major shift. The role of finance concerning the green economy has been emphasised by the majority of the studies. Examining the required volume and urgency of renewable energy production in India is crucial to understanding the need for finance in this sector. India stands at a crucial point where economic development and the welfare of its citizens rely on their access to energy. In light of the global conversation on addressing climate change and India's own Nationally Determined Contributions, the nation’s energy requirements are expected to depend significantly on clean and renewable sources. It has been projected that around 15 percent of India’s 1.25 billion population still lacks access to electricity, and it is probable that millions more continue to live in darkness, even in areas that have been classified as ‘electrified.’ (Gupta, A. R., & Bonds, G., 2020).

What is green finance and clean energy?

Particulars	Financing Transition	Green finance	Transition finance
Definition	Financing emission-reducing activities	Financing technologies that align with the Paris agreement, having zero emissions or near-zero emissions.	Minimizing emissions from sectors that are challenging to decarbonize or that play a key role in facilitating emission reductions in other areas (supportive activities). Typically, these activities cannot be reconciled with the goals of the Paris Agreement and lack viable alternatives.
Examples	Renewable energy, energy efficiency, carbon capture, forests, etc	Solar, wind, bio, etc.	Steel, cement & aviation, etc.

Source: *The Role of Coal in a Sustainable Energy Mix for India*

As per UNEP- **Green Financing**, Green Financing means to increase financial flows through banking, non-banking financial institutions (IREDA, PFC, and REC ltd), micro credit institutions, whether public, private, or nonprofit organisations, towards sustainable development. Green finance is managing environmental, social, and economic risks, grabbing opportunities that may foster environmental benefits and provide a good return on investments.
Further, investments in areas such as waste processing and recycling, biodiversity protection, water and sanitation, industrial pollution control, climate change adaptation, renewable energies, energy efficiency, and other climate change mitigation (e.g., reforestation), etc., can be given the name of green finance (Lindenberg, N. 2014). It is a broader term and may include many more areas than mentioned above.

Clean energy: Environmentally friendly Energy, having zero or near-zero emission levels and generated through solar, wind, bio, hydropower, geothermal, etc., is called renewable or clean energy. These energy sources are found in abundance and do not require years and years to replenish like non-conventional sources (oil, gas, and coal). It is also called sustainable energy.
NCSEA defines clean energy as "energy derived from renewable, zero-emissions sources ('renewables'), as well as energy saved through energy efficiency ('EE') measures".
"**Renewable energy** comes from natural processes that are replenished quickly and are inexhaustible. The primary sources of renewable energy include biomass, geothermal energy, hydropower, solar power, and wind energy."
Energy efficiency encompasses technologies (including passive solar), products, and services that minimize the energy needed for buildings, processes, or tasks. Discover more information.
In simple terms, the most sustainable energy planning scenario available is a clean energy economy that relies on both renewable sources and energy efficiency.

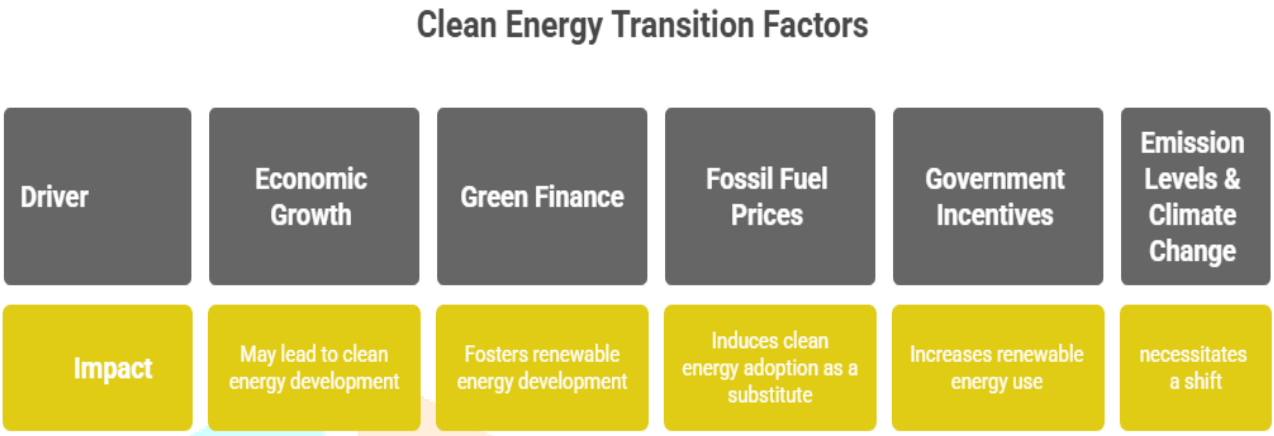
II. LITERATURE REVIEW

Several studies have been conducted concerning green finance and have confirmed that the existence of capital can promote renewable energy use, counter environmental degradation, and severe climatic conditions. A study conducted in India, taking a period of 2000 to 2020, in which carbon emission is taken as a dependent variable, which depends upon green finance, economic growth, innovation, and energy intensity. Through ARDL bounds testing and Granger causality analysis, the research identified a long-term relationship among the variables. Both green finance and technological innovation play a significant role in lowering emissions, whereas economic growth and elevated energy intensity contribute to an increase in emissions. The Granger causality analysis revealed unidirectional relationships where green finance, economic growth, and energy intensity lead to emissions, while a bidirectional relationship was found between innovation and green finance (Yadav & Dahiya, 2025). Another study conducted for Singapore, considering a similar time frame of 2000 – 2020, used the DOLS method to analyse the linkage between renewable energy and green finance. Other variables considered were carbon dioxide emissions, economic growth, energy use, oil prices, government effectiveness, and the rule of law. The findings reveal that green finance supports renewable energy development in Singapore. Other variables are also positively linked with renewable energy development in the country (Subramaniam & Loganathan, 2024). A similar study by ADBI revealed that renewable energy finance in India faces various challenges, such as high cost and policy inconsistencies. Further recommended that mobilizing necessary finance regulatory reforms and improved infrastructure are of extreme importance, and that continuous efforts will be required to create a supportive ecosystem to finance renewable energy in the country (Sarangi, 2018). In an interview-based article, Dr. Farhad Taghizadeh-Hesary emphasised the key challenges in mobilizing private finance for renewable energy projects, iterating that these projects have higher risks and lower returns than traditional sources. The article emphasizes the importance of financial tools such as green credit guarantee schemes and the allocation of spillover tax revenues to enhance the returns on green investments. It also points out the absence of standardized green ratings, which contributes to greenwashing and creates uncertainty for investors. Additionally, it underscores the influence of shareholders in promoting impact investments and ensuring that funds are directed towards truly sustainable initiatives. These observations are especially pertinent for grasping how financial mechanisms can aid the energy transition (Palmer, 2022). Another study investigates how green finance and economic fitness, i.e., globally competitive and diversified production, affect renewable energy growth and GHG emissions by incorporating GMM, FMOLS, and quantile regression for OECD countries. Furthermore, the study also analysed the impact of GDP, economic risk, government effectiveness, quality of regulations, and human capital on GHG

emissions. The results display that green finance and economic fitness reduce emissions and promote the adoption of renewable energy sources. Improving the use of renewable energy in economies can be achieved by considering key factors like GDP, efficient governance, robust regulations, economic risks, and human capital (Yi & Aziz, 2025). Additionally, a sample of 44 nations from the year 2007 to 2020 was taken into consideration, and it demonstrated that green finance, more specifically in the form of green bonds, significantly increases the output of renewable energy. The findings suggest that the effect of green bonds to finance clean energy is higher, and that even the existing capacity of renewable energy technologies generates a good amount of renewable energy when financed through green bonds, in the long run. Green finance is especially effective in nations with elevated emissions per dollar of GDP, significant vulnerability to climate change, and established credit institutions and markets. The impact is more evident in countries that are targeting low or net-zero emissions and that follow the post-Paris 2015 agreements (Alharbi, Al Mamun, Boubaker, & Rizvi, 2023). A study concerning renewable energy and green finance in India emphasized the importance of green finance in promoting renewable energy and elaborates how government programs like the NAPCC, financial tools like green bonds, and private-sector investments have sped up advancements. The research also recognizes obstacles such as regulatory inconsistencies and funding difficulties for smaller projects. In the conclusion, it underlines the necessity for more robust collaborations between public and private sectors, improved infrastructure, and stable policy backing (Khemnar & Pandey, 2024). A study on how public and private sector banks finance renewable energy projects and promote energy efficiency has been conducted in a comparative form. Various gaps in green financing practices of public and private banks have been identified through a conceptual framework, i.e., drivers, enablers, barriers, and outcomes. The paper reveals that green finance is critical in fostering sustainability and that public and private sector banks follow different approaches. Regulatory uncertainty, lack of awareness regarding green products, operational inefficiencies of public banks, high cost, and lack of proper integration of technologies are some of the challenges to green financing. It was also found that public banks need to navigate bureaucratic challenges and resource constraints, while private banks are required to innovate while maintaining a balance between profitability and sustainability. (Asha & Beriwala, 2025). A research study focusing on green finance, innovation, and the connections between energy, the environment, and climate has been carried out using a simultaneous equations model. This study examined the dynamic relationships within a sample of 49 nations that issued green bonds between 2007 and 2019. Renewable energy consumption, environmental pollution, and climate change are taken as dependent variables while innovation, green finance, economic development, climate policy, industrialization, capital, and urbanization are considered as independent and controlled variables. The study reveals that there exists a bidirectional relationship among renewable energy consumption, environmental pollution, and climate change. Innovation significantly improves renewable energy use, reduces CO_2 emissions and mitigates climate change, and effectively alleviates environmental pollution. Renewable energy use can be enhanced by innovation, through a higher level of green finance (Zhang, Chen, Tang, & Qiao, 2022). Another article that studies China's provincial-level regions for the period 2013 to 2022, empirically analyzes the drivers of renewable energy technology, and the article indicates that green finance fosters renewable energy innovation. This can be achieved through easing or liberalizing finance and promoting the green transformation of industrial sectors. Heterogeneity tests displayed varying effects of green finance on RE technology, although the positive impact of green finance in economically developed regions was stronger, and a greater promotional effect of green finance was seen in low-carbon emission regions. A threshold effect was conducted and revealed a significant threshold effect in the relationship between green finance development and renewable energy technology, indicating that once renewable energy technology exceeds this threshold limit, green finance plays a remarkable role (Shi, 2025).

Insights from the literature review

Various studies confirm that traditional energy consumption contributes to emission levels. Therefore, a shift from conventional to clean energy sources is inevitable. This shift is not possible without finance. An extensive literature review in this direction confirms that green finance has a significant positive impact on renewable energy development, generation, and consumption. It aids in adding capacity to the existing ones and fosters innovation in the renewable energy sector. Various studies also reveal that the consumption of clean energy reduces emission levels and supports the objective of reaching net-zero or near-zero emission levels. Multiple variables have been considered in various literature, and the list is not exclusive, indicating



an expanding and vast scope to this study. For instance, economic growth may lead to clean energy development, green finance helps foster renewable energy use, high coal and oil prices induce nations to use clean energy, renewable energy use increases with government subsidies and incentives, high emission levels and climate change drive nations to use clean fuels, etc.

Source: generated through napkin.ai

III. OBJECTIVES OF THE STUDY:

1. To understand the concept of green finance and its importance in renewable energy adoption.
2. To examine the role of institutions such as IREDA and REC Ltd and their financing pattern, with a focus on green bonds, loan sanctions, and disbursements.
3. To assess government efforts that aim to strengthen the green finance and renewable energy sector in India.

IV. RESEARCH GAP

Numerous studies have investigated green finance and its impact on advancing renewable energy; however, there is insufficient micro-level analysis that focuses specifically on the role of institutions. This fundamental research helps in understanding the amount of loan sanctions, loan disbursements, and the issuance of green bonds by REC Ltd and IREDA concerning the renewable energy sector in India for 2023-24. Furthermore, it highlights the government's contribution to enhancing the development of clean energy in India.

V. RESEARCH METHODOLOGY:

The study adopts a qualitative and descriptive research design relying on secondary sources of data to explore the concept of green finance and the role of institutions such as the Indian Renewable Energy Development Agency (IREDA) and REC Ltd (Rural Electrification Corporation) in financing India's renewable energy sector.

Data regarding green bonds, loan sanctions, and disbursements have been collected through secondary sources such as the annual reports (2023-24) of the Indian Renewable Energy Development Agency (IREDA) and REC Ltd (Rural Electrification Corporation). Data concerning other government initiatives in the direction of clean energy has been obtained from IBEF (India Brand Equity Foundation), Press Information Bureau, and the Institute for Energy Economics & Financial Analysis.

VI. DATA PRESENTATION / DATA ANALYSIS

Table 1. Analysing the Indian Renewable Energy Development Agency's role in the RE sector.

Loan Portfolio of IREDA as on 31/12/2024		
Particulars	**Amount**	**%**
Loan facility to state utilities	14313.93	20.7570
Wind energy	12700.12	18.4168
Solar energy	17807.91	25.8237
Small hydro	8680.73	12.5881
Short term loans	1001.08	1.4517
Biomass and Cogen	6601.75	9.5734
Others	7854.08	11.3894
Total	**68959.6**	

Source https://www.ireda.in/home?mode=dark

As of December 31, 2024, IREDA's total loan portfolio stands at ₹68,959.6 crore, with solar energy receiving the most significant allocation at 25.82%, demonstrating a strong commitment to clean energy advancement. A notable portion is also directed towards state utilities (20.76%) and wind energy (18.42%), underscoring IREDA's comprehensive approach to infrastructure development and a variety of renewable sources. Investments in small hydro (12.59%) and biomass & cogeneration (9.57%) reflect a moderate focus on decentralized and sustainable energy solutions. A smaller fraction is allocated to short-term loans (1.45%) and emerging sectors (11.39%), illustrating IREDA's dedication to a diverse and long-term strategy for clean energy financing.

IREDA's loan sanctions and disbursements

During FY 2024 company sanctioned loans amounting to Rs 37,353.68 crore, which is an increase of 14.63% compared to the previous year (Rs 32,586.60 crore). Loans disbursed during FY 2024 amounted to Rs 25,089.04, which was an increase of 15.94% compared to the previous year's disbursed loan (Rs 21,639.21 crore). Sector-wise details are mentioned in the table below.

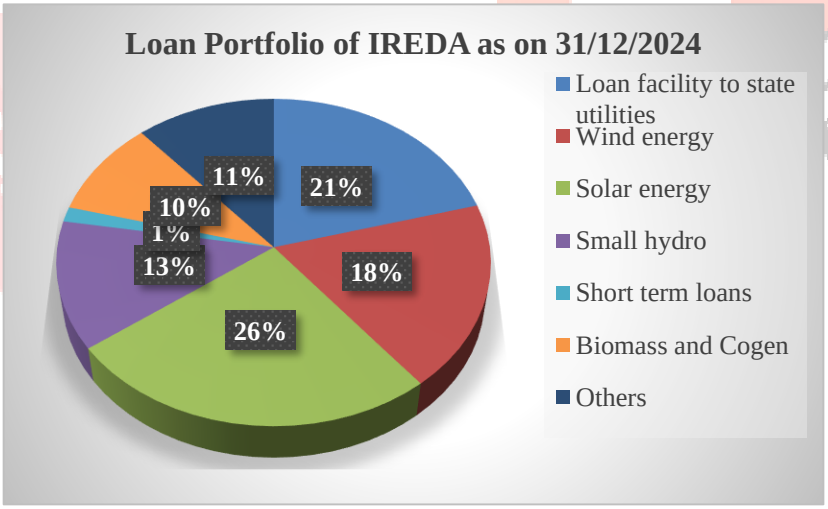


Table: 2

Sectors	Sanctions (₹ in Crore)	% of Sanctions	Disbursements (₹ in Crore)	% of Disbursements
Solar Power	6065.3	16.24	5879.35	23.43
Wind Power	2096.83	5.61	3020.59	12.04
Hydro Power	1419.89	3.8	2660.78	10.61
Manufacturing	6754.48	18.08	2404.49	9.58
Hybrid Wind & Solar	1634.02	4.37	140	0.56
Ethanol	3901.6	10.45	2017.86	8.04
Electrical Vehicle	1062.44	2.84	593.39	2.37
Short Term Loan	1884.5	5.05	918.73	3.66
Biomass	412.24	1.1	112.64	0.45
Biomass Power & Cogeneration	103	0.28	98.41	0.39
Waste to Energy	102.7	0.27	85.63	0.34
State Utilities-Genco	1000	2.68	1000	3.99
State Utilities- Discoms and others	6200	16.6	5200	20.72
Miscellaneous (Transmission)/ Emerging Technology	4716.68	12.63	957.17	3.82
Total	**37353.68**	**100**	**25089.04**	**100**

Source: annual reports IREDA 2023-24 (37th annual report)

Sector-wise analysis of loan sanctions and disbursements in India's renewable energy sector reveals key trends. Manufacturing received the maximum share of sanctioned funds, i.e., Rs 6754.48 crore (18.08%), followed by State Utilities-Discoms and others, Rs 6200 crore (16.60%), and Solar power, Rs 6065.3 crore (16.24%). In terms of disbursements, Solar Power led the sector by receiving Rs 5879.35 crore (23.43%), revealing a strong capacity-building strategy and policy priority. Subsequently, State Utilities – Discoms received Rs 5,200 crore, accounting for 20.72%, along with Wind Power, which attracted Rs 3,020.59 crore, representing 12.04%. This signals a consistent inflow of investments into renewable sectors.
Loan sanctioning in the case of Hydro Power was only Rs 1419.89 crore, but interestingly, it recorded disbursements of Rs 2660.78 crore, possibly due to the previous year's carry forward. Ethanol and EV saw moderate sanctions and healthy disbursements, indicating that their presence is crucial, even though in small proportions. Disbursements in the case of Hybrid Wind & Solar and Biomass-based projects revealed some weaknesses in fund utilization, indicating operational inefficiencies and regulatory barriers. Miscellaneous (Transmission)/ Emerging Technology received notable sanctions, having a share of 12.63 % but a weak disbursement scenario, i.e., 3.82% only, probably because of being in preparatory stages. In total, of the Rs 37,353.68 crore approved, Rs 25,089.04 crore was distributed, resulting in an overall disbursement efficiency of around 67%. This discrepancy is typical in sectors focused on infrastructure, where project durations frequently exceed the original sanctioning schedules.

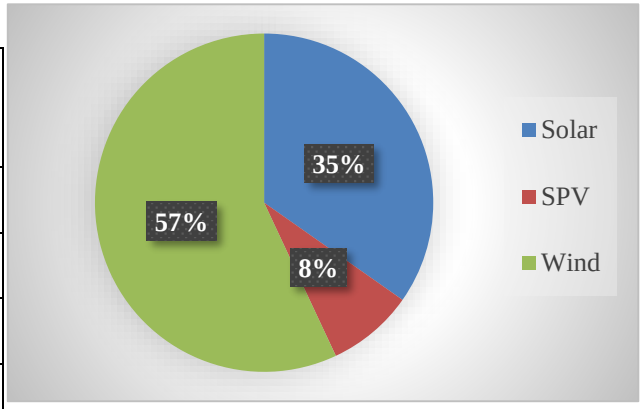
Green Bonds issued by IREDA

The company also raised Domestic Taxable Green Bonds during the financial years 2017 and 2019, worth Rs 700 Crore and Rs 865 Crore, respectively. The amount of the loan or proceeds was utilized in financing the solar and wind sector, including refinancing of eligible projects. This has contributed to a positive impact on the environment and has strengthened India's energy security, reducing reliance on fossil fuels.

Utilization of Funds received from green bonds 700 crore (in table Rs 7000 million)

Table: 3

Sectors	Amount in INR Million
Solar	2,431.95
SPV	580.05
Wind	3,988.00
	7,000.00

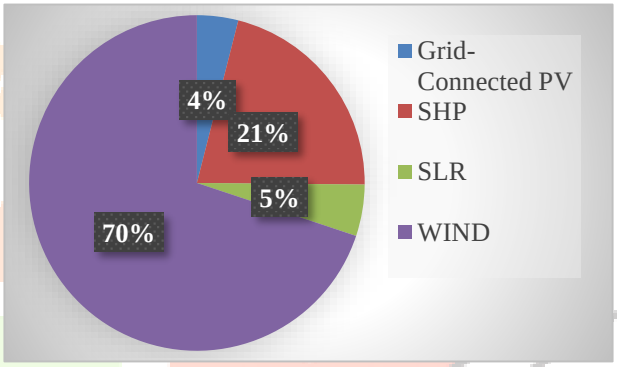


Source: https://www.ireda.in/images/HTMLfiles/AnnualReportDomesticBond.pdf

Utilization of Funds received from green bonds, Rs 865 Crore (in table Rs 8650 million)

Table: 4

Sectors	Amount in INR Million
Grid-Connected PV	343.73
SHP	1,832.27
SLR	428.81
WIND	6,045.19
TOTAL	**8650**



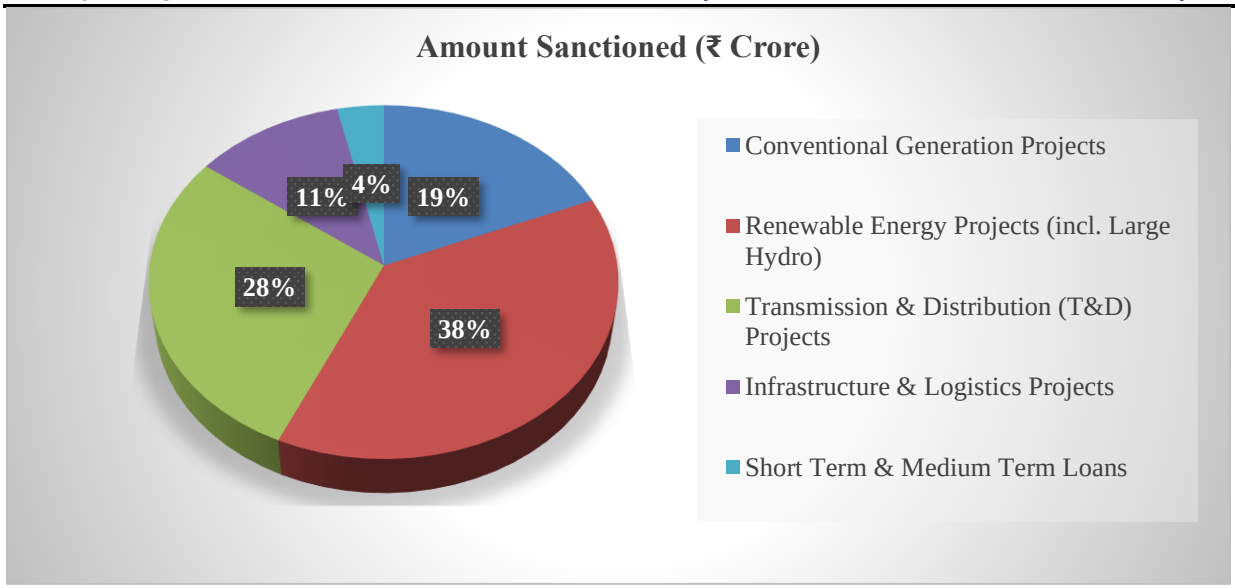
Source: https://www.ireda.in/images/HTMLfiles/AnnualReportDomesticBond.pdf

Analysing the role of REC Ltd (Rural Electrification Corporation) in the RE sector in India.

Table 5. Amount Sanctioned by REC Ltd

Category	Amount Sanctioned (Rs Crore)	Financial Year
Total Loans Sanctioned	358816.34	2023–24
Total Loans Sanctioned	268460.54	2022–23
Category	**Amount Sanctioned (Rs Crore)**	**Financial Year**
Conventional Generation Projects	67112.15	2023–24
Renewable Energy Projects (incl. Large Hydro)	136516.17	2023–24
Transmission & Distribution (T&D) Projects	101994.08	2023–24
Infrastructure & Logistics Projects	40568.92	2023–24
Short-Term & Medium-Term Loans	12625.02	2023–24

Source: REC ltd 55th annual report 2023-24



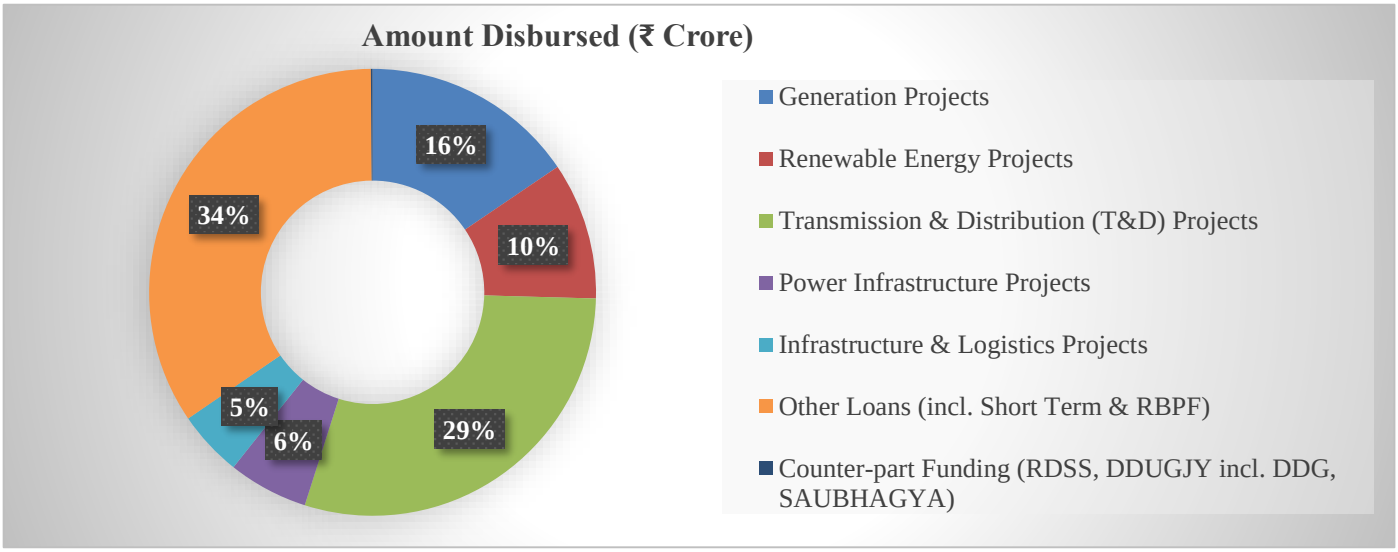
In the FY 2023-24, REC Ltd sanctioned loans worth Rs 358816.34 compared to 268460.54 in 2022-23, which is a significant rise in the sanctioning amount. Maximum funds were allocated to Renewable Energy Projects (including Large Hydro), i.e., Rs 136516.17 crore, which indicates a strong push towards clean energy initiatives. Then followed by Transmission & Distribution (T&D) Projects, which were allocated Rs 101994.08 crore, portraying continued investment to improve power infrastructure. Conventional Generation Projects were allocated Rs 67112.15 crore, indicating the significance of energy security, which comes from conventional sources, and their role in India's current energy portfolio. Furthermore, Rs 40,568.92 crore has been designated for Infrastructure and Logistics Projects, which are essential for the growth of related sectors vital to economic development. Amount sanctioned for Short-Term & Medium-Term Loans was Rs 12,625.02 crore, reflecting need-based financing. This data, although insufficient for making a judgment, portrays a promising transition towards clean energy development.

Table 6: Amounts disbursed by REC Ltd

Category	**Amount Disbursed (Rs Crore)**	**Financial Year**
Total Disbursements	161462.28	2023–24
Total Disbursements	96846.3	2022–23
Category	**Amount Disbursed (Rs Crore)**	**Financial Year**
Generation Projects	25053.77	2023–24
Renewable Energy Projects	16024.22	2023–24
Transmission & Distribution (T&D) Projects	47582.22	2023–24
Power Infrastructure Projects	9339.4	2023–24
Infrastructure & Logistics Projects	7675.84	2023–24
Other Loans (incl. Short Term & RBPF)	55589.51	2023–24
Counter-part Funding (RDSS, DDUGJY incl. DDG, SAUBHAGYA)	197.32	2023–24

Source: REC ltd 55th annual report 2023-24

In the FY 2023-24, a total of Rs 1,61,462.28 crore was disbursed compared to Rs 96,846.30 crore in the previous FY, reflecting a notable increase in disbursements as well. Maximum share (34%) went to Other Loans, including Short Term and Renewable-Based Power Projects Financing (RBPF), indicating strong and specific financial assistance to projects that were already running on renewable power. Transmission & Distribution (T&D) Projects received Rs 47582.22 crore (29%), indicating the importance of improving grid and power infrastructure, which aids RE use. Generation projects received Rs 25053.77 crore, which includes both renewable and non-renewable energy projects. Specific disbursement in case of renewable energy projects was around 10%, i.e., Rs 16024.22 crore, indicating moderate but consistent support for clean energy implementation. A smaller percentage was allocated to Power Infrastructure Projects (6%) and Infrastructure & Logistics Projects (5%). The counterpart funding for government initiatives such as RDSS and SAUBHAGYA was limited to Rs 197.32 crore (<1%), indicating that the majority of disbursements were driven by the market rather than being based on grants.



Green Bonds issued by REC Ltd

Table:7

Sr No.	Fund Raised (FCY)	Month and Year	Tenor
1	USD 450 million Green Bond	July 2017	10 Years
2	USD 750 million Green Bond	April 2023	5 Years
3	JPY 61.1 billion Green Bond		
	JPY 31.00 billion Green Bond	January 2024	5 Years
	JPY 27.4 billion Green Bond	January 2024	5.25 Years
	JPY 2.7 billion Green Bond	January 2024	10 Years

Source: REC ltd 55th annual report 2023-24

REC issued USD 750 million in April 2023 for 5 years through USD Green Bonds. This issuance marks the first Green Bond issuance by an Indian firm following India's G20 Presidency and represents the largest Green Bond Tranche by an issuer from South & South-East Asia. The funds generated from these bonds are being allocated to approved green projects under REC's Green Finance Framework. Moreover, in January 2024, REC raised JPY 61.1 billion, marking its 11th foray into the international bond market and its first issuance of Yen Bonds. This marks the first time any Indian public sector undertakings have issued Yen Green Bonds. The bond issuance featured terms for 5-year, 5.25-year, and 10-year bonds. This was the largest Euro-Yen issuance in South & South East Asia and the biggest Yen-denominated issuance from India. The transaction garnered interest from both Japanese and international investors, with orders split evenly at 50%, making the international allocation one of the highest for any Indian Yen deal. These proceeds have been employed to finance wind, solar, and renewable purchase obligations, which include refinancing of eligible projects (as per the Green Bond framework of REC Ltd), reducing dependency on traditional sources, thereby strengthening India's energy security and contributing to sustainable development.

Other Government initiatives:

According to the India Brand Equity Foundation (IBEF), the following are the government initiatives and efforts concerning the RE sector.

- PM JI-VAN Yojana (2024 update): Approval of ₹908 crore for cutting-edge 2G bioethanol initiatives utilizing renewable feedstock, including a commercial facility in Panipat, Haryana.
- Rajasthan-NTPC MoU: A ₹1.6 lakh crore investment for power projects generating 31,825 MW, which encompasses 28,500 MW of renewable energy capacity to enhance Rajasthan's energy independence.
- Green Hydrogen Budget 2024-25: The allocation has been increased to ₹600 crore; Indian firms are set to invest $800 billion in green hydrogen, clean energy, electric vehicles, and semiconductors.
- Power Transmission Investment: An investment of ₹9.12 lakh crore is planned by 2032 to broaden the electricity infrastructure.

- PLI Scheme – Solar PV: ₹19,500 crore has been earmarked under Tranche-II for the manufacturing of 39,600 MW solar modules; Letters of Award were issued in April 2023.
- Ladakh Renewable Projects: The Ministry of New and Renewable Energy proposed 13,000 MW of renewable energy and 12,000 MWh of Battery Energy Storage Systems; ISTS received approval for grid connection in October 2023.
- Solar Parks Expansion: The capacity target has been increased to 40,000 MW; 50 parks have been approved (37,490 MW), with 10,401 MW commissioned by November 2023.
- PM Surya Ghar Yojana (February 2024): Provides free rooftop solar electricity to 1 crore households through subsidies and loans.
- PM-KUSUM (December 2023): A total of 140 MW of solar plants and 2.73 lakh standalone pumps have been installed to aid farmers and promote sustainability.
- Budget 2023-24 – Green Growth: Green Growth as one of the SAPTARISHI priorities.
- Pumped Storage Push: The budget includes the formulation of a framework for pumped storage projects.
- Sustainable Cities Initiative: States are encouraged to implement urban reforms for greener cities as part of Budget 2023-24.
- COP26 Commitments: India aims for net-zero emissions by 2070 and 500 GW of renewable energy by 2030, fostering confidence among investors and stimulating sector growth.
- Ladakh ISTS Support (Budget 2023-24): An allocation of ₹8,300 crore has been made for the transmission of 13 GW of renewable power.
- Kameng Hydro Project (November 2023): A 600 MW hydroelectric project was inaugurated in Arunachal Pradesh, constructed at a cost of ₹8,200 crore.
- Sovereign Green Bonds Framework (November 2023): Approved to draw in capital and support India's commitments under the Paris Agreement.
- SECI Allocation (Budget 2022-23): ₹1,000 crore has been allocated for the development of renewable energy through SECI.
- PLI Scheme for Solar Modules: ₹19,500 crore has been allocated to enhance the manufacturing of high-efficiency solar modules.

Challenges, strengths, opportunities, and risks associated with NBFCs and Green financing

Challenges	There is excessive reliance on bank borrowings by many NBFCs, specifically in power and infrastructure.
	High borrowing costs are a big challenge for NBFCs as they face competition from public sector units, banks, and the domestic bond market.
	It is difficult for lower-rated NBFCs to access the bond market or raise funds due to high bond costs and risk profiles.
	Private credit markets or alternative investment funds are still in their emerging stage, which makes it difficult for them to contribute to lending funds.
Strengths	Key institutions like REC, PFC, and IREDA, together, have planned to allocate Rs 14 trillion towards green financing.
	NBFCs are positioned strategically to finance clean energy and low-carbon infrastructure.
	Although smaller NBFCs are into AIF and exploring co-lending, larger NBFCs are successfully raising funds through bonds and strengthening the bond market.
	ESG-focused alternative investment funds and co-lending facilitate risk sharing and foster green lending activities.

Risks	There is a lack of risk diversification due to rapid NBFC lending to the power sector, and more importantly, 50 government-owned NBFCs represent 40% of the overall corporate credit within the NBFC sector, primarily associated with the power industry.
	Banks are exposed to high risk due to lending to NBFCs in the form of loans, debentures, and commercial papers, and a downturn in the power sector may cause financial instability in the banking system.
	The RBI's 25% hike in risk weights for bank loans to NBFCs rated from AAA to A raises the cost of funding and restricts banks' exposure.

Opportunities	US Fed cut may improve credit creation, and prove to be favourable for Indian NBFCs, which can raise dollar-denominated green debt from global markets.
	The financial sector's commitment of Rs 24.8 trillion towards clean energy by 2030.
	Co-lending and growth in Alternative Investment Funds (AIFs) provide opportunities to small NBFCs, for instance, raising capital from ESG investors.
	Expected rise in FDI and FPI due to the rate cut.

Source: IEEFA

According to the Institute for Energy Economics and Financial Analysis (IEEFA, 2024), if India is to achieve its net-zero target by 2070, a holistic transition to renewable energy is necessary. A multifaceted approach will be needed, which would include policy frameworks, investment strategies, and technological innovation. India's renewable energy policy has helped it to become a global leader in this sector. Clean energy capacity has grown 1.5 times to 191 GW between FY 2014 to FY 2024, which represents 43% of total energy capacity. The notable increase in renewable energy tenders awarded (from 4.2GW in Q3 2023 to 19.7GW in Q1 2024) showcases significant growth in the industry. The introduction of sophisticated tenders, such as firm and dispatchable renewable energy, signifies a strategic approach to tackling the intermittency issues associated with conventional solar and wind projects by leveraging technological innovations to provide a reliable electricity supply. The sector has obtained US$5.8 billion in funding in the form of debt-equity to facilitate the construction of new projects in 2023. However, given the rate at which the renewable energy sector has grown so far, finance availability needs to be increased simultaneously.

Banks and NBFCs

Non-Banking Financial Companies (NBFCs) and local banks offer loans for renewable energy initiatives that are currently being developed. However, there is a lack of long-term financing alternatives available from banks. Hence, the capital market plays a crucial role in financing these projects post their construction period, exposing them to market risks. Banks face regulatory hurdles, notably under the Basel III framework, concerning long-term funding for these projects, discouraging long-term loans. Moreover, RBI guidelines for such loans and advances require lenders to make provisions up to 5%, impacting profitability and rising costs. This might result in more careful lending practices, especially impacting low-margin industries such as renewable energy. Still RE sector's growth and performance have made it an attractive sector for long-term loans and advances. Clean energy sector's loss given default (LGD) is lower than other sectors, reflecting potential for green financing. Availability of credit from banks for other power sector sources fell from 13% year on year in January 2024, while it increased for the RE sector by 17%, possibly due to untapped potential. Lender confidence has significantly increased due to supportive policies like long-term Power Purchase Agreements (PPAs), guaranteed operational status for renewable energy initiatives, and exemptions from transmission costs, combined with quasi-sovereign bidding for Firm and Dispatchable Renewable Energy projects.

Capital market and renewable energy

Financing and refinancing in the capital markets via bonds play an important role in the RE sector. Capital can be obtained through international sustainable finance or the local bond market; however, the local bond market tends to be shallow and lacks liquidity, while financing through the global market faces the risk of exchange rate fluctuations due to unpredictable global interest rates. Indian firms saw a 14-year low in dollar bond fundraising, inducing them to shift to local borrowings because of higher hedging costs and unfavourable global interest rates. If currency risk and hedging costs keep increasing, there will be no incentive left for foreign investors to invest in the domestic bond market. Renewable energy sector-specific facility, such as subsidising the cost of rupee hedging, may help in raising funds from foreign investors.

Domestic institutional investors and the domestic bond market

DIIs like pension funds and insurance firms, which account for 40% of the bond market, can play an important role in financing this sector. Renewable energy bonds face challenges to acquire funds from DIIs due to their low ratings, i.e., below AA, suggesting that RBI measures such as credit default swaps and partial credit enhancement have limited success potential. In this case, Infrastructure investment trusts (InvITs) can play a significant role by attracting funds from DIIs by monetising renewable energy assets with high credit ratings. A government-owned renewable energy infrastructure investment trust (InvIT) could serve as an effective means for financing clean energy initiatives and drawing in domestic institutional investment (DII) capital.

With so many renewable energy projects in progress, the government's focus should be on enhancing financial availability. On the other hand, significant changes in banking and the capital market are necessary for a successful energy transition.

VII. Limitations and scope for future research

This study is qualitative, reflecting government efforts and the financing patterns of REC Ltd and IREDA for the year 2023-24. Year-wise comparison of data, as well as inter-firm comparison, will give further meaningful insights. In-depth analysis of funding through the bond market and fund utilization, and its impact on renewable energy in India, may also be incorporated in future studies.

VIII. Conclusion

This study highlights the important role of green finance in renewable energy expansion in India. Institutions like IREDA and REC Ltd have played a significant role by scaling up their loan portfolios and green bond issuance with a concentrated focus on solar and wind energy. However, the study also reveals inconsistencies concerning loan sanctions and disbursements in hybrid and emerging technologies. While green bonds have proven to be successful but there is still room for improvement compared to the rate at which the renewable energy sector is growing. Also, high hedging costs, limited issuance of bonds, and the illiquid nature hinder long-term funding options. Limited access to funds for smaller NBFCs and a lack of a standardized green framework limit the flow of green finance. Additionally, the study identifies the risk of concentrated lending of NBFCs to the power sector, and exposure of banks to NBFCs, if not managed properly, may cause financial instability. Even with favourable policy structures in place, obstacles such as increased borrowing costs, cautious lending practices, and infrastructure constraints continue to exist. India needs a good green finance framework that includes strong involvement of private investors and DIIs, standardized regulatory processes, risk-mitigating techniques, transparency in fund utilization, and incentive-based credit lending schemes. Financial instruments such as Alternative Investment Finance and Infrastructure investment trusts, InvITs, can attract further capital. An improved, focused, and equitable financial approach is essential to achieve India's renewable energy objectives and guarantee a fair and sustainable transition in energy.

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