The Clean Development Mechanism and Corporate Financial Performance: Empirical Evidence from India

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Abstract: An important factor supporting the social economy's sustainable growth is the industry's development in renewable energy. India has a sophisticated system that combines finance, resources, technology, and management to grow, expand, and modernize the renewable energy industry. Renewable energy finance is a new area of public policy that will significantly affect international investors and calls for innovation and study. Many academics held the opinion that issues with renewable energy were limited to science and engineering until recently. But rather than relying on science and technology, the future of renewable energy increasingly lies on financial accessibility. The rapidly growing renewable energy business in India presents a great opportunity for financial gain. The current paper's goal is to assess the financial performance of India's renewable energy sector using a variety of financial metrics and various ratios. The different industrial stakeholders are impacted by the financial performance of every industry. Data from the corresponding firms' annual reports was used to analyze the financial performance of renewable energy companies, and the study's findings were determined using a t-test. According to the study's findings, India's renewable energy companies are still in their infancy and are working hard to keep their steady financial positions.

Keywords: Financial Performance, Renewable Energy, Financial Ratio, India, Global Environment.

I. Introduction

A higher level of living and human welfare depends on energy. It is a modern product that significantly affects human lives. In terms of national security and the economy, it is strategically important. Nowadays, conventional energy sources make up the bulk of the world energy market. According to Murdock et al. (2019), the conventional energy sector constituted 81.9% of the overall final energy consumption in 2017. These traditional energy sources have inconsistent supply and are unreliable for a sustainable future. Additionally, utilizing them puts the environment at danger and releases a lot of pollutants, such as CO2 and other gases that contribute to global warming.

The risk that environmental degradation presents to public health has led to a global reassessment of energy strategies. To enable this major shift in the energy industry and build a sustainable earth, the development of an alternative to conventional energy sources is promoted. The previous attempts at reducing greenhouse gas emissions through "joint implementation" and "clean development mechanism" under the Kyoto Protocol Agreement were incorrect from the beginning (Brand, 2015). The concept of shared but distinct commitments is the basis of the Kyoto Protocol. Developed nations are mandated by this convention to decrease their current emissions. The collapse of the Kyoto Agreement led to the creation of the Paris Agreement. It aims to strengthen the international response to the threat posed by climate change in the framework of sustainable development. It conveys the idea of common but distinct duties and fairness in the context of diverse national circumstances. Planning, announcing, and upholding each successive national determined contribution that each Party intends to make are requirements (Paris Agreement, 2015).

India presents an opportunity for the rapidly growing renewable energy sector due to the country's plentiful renewable energy resources. It can capture renewable energy from a range of sources and enjoys a variety of pleasant weather conditions. The Indian renewable energy market ranks fourth globally, with a score of 63 on the Renewable Energy Country Attractiveness Index (RECAI) (Warren, 2015). India has the capacity to produce 1000 GW, and by 2022, it hopes to reach its ambitious target of producing 175 GW of renewable energy. The Union Ministry of New and Renewable Energy (MNRE) reports that the capacity of renewable energy has allegedly surpassed 81 GW, or more than 22 percent of the country's total installed capacity (Priyavrat Bhati, 2019).

The Indian government has initiated several noteworthy large-scale sustainable power projects and is aggressively promoting the use of renewable energy sources (BRISCON, 2019). India's capacity to produce wind energy has increased by 1.7 times in the last four years. Solar power capacity increased by more than 11 times in the last five years, from 2.6 GW to 28.18 GW in March 2019. Wind power made

the greatest contribution, accounting for 46% of the total, or over 36 GW. With 36%, solar has the second-highest percentage. (30 GW). Successful small hydro projects supplied 6% of the market, while biomass accounted for 12% (9 GW) of the remaining market (5 GW) (Invest India, 2019).

In order to boost the usage of renewable energy sources and reduce the economy's carbon footprints, India wanted to implement multiple initiatives using various concepts and technology. To promote investment in the region, several policies were implemented. The Indian renewable energy market anticipates a significant inflow of foreign and domestic investment to meet demand and successfully complete the project. The nation pledged to invest $11 billion, of which $6.9 billion will go toward solar energy and $4.1 billion will go toward wind energy (Inger Anderson, 2019). Data released by the national investment promotion and facilitation agency shows that between April 2000 and June 2018, the amount of foreign direct investment (FDI) that went into the Indian non-conventional energy sector was US$ 6.84 billion. Furthermore, FDI of roughly US$2.10 billion was allocated to equity. Given the above climate of large expansion and investment inflow into the Indian renewable energy sector, it is imperative to review the business's performance and correlate it with the investor's experience. Thus, the purpose of this study is to assess the financial performance of India's renewable energy industry. To achieve the goals of the current study, a range of financial parameters were employed to evaluate the financial performance of renewable energy enterprises.

II. Statement of Problem

Among the world's most pressing challenges is global warming. Projects utilizing renewable green energy significantly contribute to global emission reduction. It's a problem that the globe is starting to face in the modern day. Many studies have been done or are currently being done to evaluate the performance of renewable energy projects on a national and worldwide scale, however there aren't many studies that focus on the financial performance analysis of renewable energy projects in the context of India. Thus, the goal of the current study is to analyze the financial performance of renewable energy projects in order to comprehend and assess the effectiveness of these CDM initiatives in India.

III. Literature Review

A better earth is built on renewable energy. It gives the earth a chance to lessen carbon emissions, improve air quality, and establish a more sustainable civilization. It also provides countries with the opportunity to boost economic growth and energy security (Kumar et al., 2010). By employing renewable energy, greenhouse gas emissions that warm our world can be prevented. It improves air quality as well as human health. There is also a financial potential to invest in renewable energy. around

the past ten years, investors from all around the world have been increasingly making this decision. Renewable energy is thought to be a more desirable fuel source than traditional fuels because it carries less risk and is not affected by natural disasters. The three main drivers of the renewable energy industry's expansion are reduced carbon dioxide emissions, economic benefits, and energy security (Abolhosseini, 2014). A UNEP research states that $272.9 billion was invested worldwide in the renewable energy market in 2018. Anderson, Inger (2019). Over the next ten years, the market for renewable energy will grow and spread throughout numerous countries. The more idealistic, long-term objective of clean and green energy is a sustainable world. It demands innovation in thinking, new technology, and adaptability in operations. If the cost cap is met, the energy mix will unavoidably change, which is one of the main drivers of the renewable energy industry. Technology must be redesigned in order to achieve the aforementioned objective.

In order to meet the energy demands of its inhabitants while reducing carbon emissions from both the generation and demand sides, the Government of India (GoI) has put in place a number of policy initiatives. These actions are meant to help the worldwide endeavor to use more renewable energy sources and grow the planet sustainably. From a supply and generation perspective, the aim is to promote the growth of the renewable energy industry within the country's economy. India wanted to increase its use of solar and wind energy in order to increase its renewable energy capacity from 80.46 GW to 175 GW by the year 2022, as stated in its 2015 wanted Nationally Determined Contribution. If this ambitious target is met, India will be among the world's leading producers of renewable energy (Year-End Review, 2018). Initiatives are being made on the demand side to improve energy efficiency through a range of innovative legislative strategies that promote public awareness. India aims to cut its energy use by 10%. As a result, it planned to replace India's low-efficiency household appliances with new ones utilizing extreme management techniques. According to Thambi (2018), the Indian government has deliberately decided to lower the GDP's emissions intensity by 20–25% by 2020 when compared to 2005 levels. To support the above expansion, the proportion of renewable energy grid capacity is increased six times, from 3.9 GW (2%) to 36 GW (13%).

Sharma, C. et al, (2017) worked upon mathematical frameworks which determine the required level of an incentive to reduce the levelized cost of electricity generated by solar thermal power. Gupta, J. (2016) in his studies assessed the effects of Paris Agreement climate Change on developing countries but big emitters of GHGs China and India and concluded that both the countries accepted agreement and slowly adapting green technology which considerably sacrifice energy field and gaining hydro field. Haldar S. (2017) in her study on green entrepreneurship in the renewable energy sector of state Gujrat,

emphasized on the push and pull factors to engage in greener production by studying the attributes, triggers and barriers faced by entrepreneurs. Elavarasan, R.M., et al. (2020) worked upon the Renewables Energy scenario in states Gujarat, Tamil Nadu and Karnataka which pioneers in Energy production in India. Also found the barriers affecting projects and policy development by Government in growth of this sector.

Shah, A.N. (2016) focused her work on energy sector organizations of Gujarat and examined factors affecting the CDM projects, barriers faced by the organization, risk involved in CDM projects undertaken by organizations and impacts. The study concluded that solar and wind technology is majorly using by organizations in Gujarat for CDM projects due to the geographical location there. The risk of capital cost over-run, operational risk and supply risk influence most to CDM projects. Carbon Credit positively deploys CSR activities.

Ravindranath, et al. (2017) highlighted the need for large scale research, modeling and monitoring, reporting and data requirements for India while having the need for transparency, accuracy, comparability, completeness and consistency. And India needs to work on large scale research and data generation to timely achieve their target of Paris agreement. Klimenko, V.V., et al. (2019) analyze the changes in the world power industry and assess the extent to which the commitments of the Kyoto Protocol had been met and also to evaluate the prospects of the Paris Agreement. The findings revealed the thermal power stations reduce the emissions by 5.2 billion tonnes, electric energy reduction 1.1 billion tones and carbon capture and storage technologies reduce only 0.2 billion tonnes. Rattani, V. (2020) find the approach and the role of India and the EU towards the Paris Agreement. EU is leading in enhancing its short as well as long term benchmarks and also providing financial and political support to poor, developing and island countries while India is comparatively slow in the race.

Garg, A.K., et al. (2017) interpreted that improvement of social status, reduction in overall cost, additional revenue, funds for R& D, improved market share value as benefits of carbon credit trading while ambiguity, taxation issues, encourage wealthy people to move towards unsustainable ways, improper accounting standards, documentations as challenges of Carbon Credit Trading.

India's need for electricity would almost triple and its entire energy consumption will more than quadruple by 2030. India must invest heavily in the renewable energy sector if it is to meet its ambitious targets for economic growth and to ensure that its growing population has access to energy. Investment in India's renewable energy sector has increased in the last five years. It has exceeded the thermal power sector's capital spending, which was about 20 billion USD in 2018. Declining costs of technology, supportive laws, and ambitious targets are driving investment in the Indian renewable energy business (Arjun Dutt, 2019).

India has the potential to become a worldwide and regional leader in the shift to renewable energy, surpassing several affluent countries with one of the largest and most ambitious renewable energy projects globally (Gielen, 2019). The US-based Institute for Energy Economics and Financial Analysis (IEEFA) estimates that for India to meet its renewable energy targets, the country will require $500–700 billion for the renewable energy sector over the next ten years (Buckley, 2019). India had the fastest growth rate in 2017, contributing $12.3 billion, or roughly 5% of the global GDP. This represented a 62% increase over the $7.6 billion comparable amount for 2016.

Research Gap

The material that is currently available makes it clear that the majority of the study was primarily concerned with climate change, carbon trading, renewable energy, and CDM initiatives. While several studies explore the Paris Agreement, few address the accounting and taxation of CERs. Examining the financial outcomes of Indian renewable energy companies handling CDM projects is vital, as evidenced by the work now in publication.

IV. Objectives of the Study

- To discuss the present situation of renewable energy in India.
- To analyze the financial performance of selected renewable energy companies of India.

V. Research Methodology

The annual financial statements of three major renewable energy companies Adani Green Energy Ltd., Reliance Ltd., and Tata Power Ltd. provide the data for this study. Five years' worth of yearly public financial statements from 2017–18 to 2021–22 are used to compute key financial ratios such the current ratio, quick ratio, debt equity ratio, return on capital used, and return on asset. During this time, various financial data are gathered and processed. The mean and standard deviation of each financial ratio are calculated in order to evaluate the financial performance of the selected renewable energy enterprises.

Nature and Sources of Data

The proposed research work is primarily based on Secondary Data. The financial data and information required for the study are drawn from the annual reports of respective renewable energy company; reports of UNFCCC, Govt. of India, Ministry of New and Renewable Energy were used as the secondary data sources.

Sample of the Study

This research will be conducted to analysis the financial performance of some selected renewable energy companies of India which are running CDM projects in the country with an intention of studying the financial feasibility of the projects. The following companies were considered for the purpose of research:

S. No.	Company	Current Market Price (Rs.)
1.	Adani Green Energy Ltd.	1920.9
2.	Reliance Industries Green Energy Ltd	2442.65
3.	Tata Power Ltd.	220.07

Source: Data taken from Annual Financial Statements of Sample Companies

Adani Green Energy Limited (AGEL): One of India's major renewable energy firms, Adani Green Energy Limited (AGEL), has a current project portfolio of 20,434 MW. The Adani Group has pledged to provide India a better, cleaner, and greener future, and AGEL is a part of that. The federal, state, and government-backed enterprises are given access to the electricity produced. Due to long-term Power Purchase Agreements (PPAs) of 25 years with federal and state government agencies, AGEL has grown its footprint across 12 Indian states by utilizing its resources. The business employs the most recent technologies in its initiatives. AGEL, which now has 54 active projects in its portfolio and 12 projects under construction, is spearheading India's shift to renewable energy.

Reliance Industries Green Energy Ltd: In order to secure the promise of a sustainable future for future generations, we at Reliance have set an ambitious goal to achieve net-zero carbon by 2035. To that end, we are investing over USD 10 billion (Rs 75,000 crore) in creating the most extensive ecosystem for New Energy and New Materials in India. The best combination of clean, economical, and dependable energy solutions using fuel cells, solar, wind, and hydrogen will be found in the new energy industry. The business constructed the Dhirubhai Ambani Green Energy Giga Complex, a fully integrated renewable energy ecosystem that is being developed across 5,000 acres near Jamnagar. The Dhirubhai Ambani Green Energy Giga Complex is being built by the firm on more than 5,000 acres in Jamnagar. This will be one of the world's biggest integrated production complexes for renewable energy. The corporation is investing Rs 60,000 crores to build cutting-edge, global facilities for the production and integration of vital parts of the New Energy ecosystem.

Tata Power Company Ltd.: It is one of the biggest participants in renewable energy in India and is well-positioned to respond to the country's shifting priorities in this area. Tata's Renewables Business aims to supply the nation with energy derived from renewable natural resources, such as the sun, wind, and force of nature. Tata Power is the industry leader in promoting wind power development in India, with installations spanning seven states: Maharashtra, Gujarat, Tamil Nadu, Karnataka, Rajasthan, Andhra Pradesh, and Madhya Pradesh. The company has an installed capacity of 932 MW for wind power generating. The 100 MW Nimbagallu wind farm in Andhra Pradesh and the 21 MW Vagarai wind farm in Tamil Nadu were recently put into service by Tata Power's subsidiary TPREL. At the most recent COP 26, solar power generation has taken center stage. This is the age of the energy prosumer, who not only produces energy but also consumes it. Tata Power boasts a robust solar generation portfolio with 2,688 MW of capacity (Tata, 2023).

Period of the Study: The current analysis spans five years, from 2017-18 to 2021-22, in an effort to derive significant conclusions regarding the financial performance of particular registered CDM projects. The decision-making process also considers the data's accessibility.

Methods to be used for Data Collection: Several sources provided the data that were gathered for the study. The company's annual reports and other pertinent data were obtained from the internet and the websites of the chosen renewable energy providers. For the purpose of the research, several periodicals, magazines, newspapers, and edited books have been taken into consideration.

Tools and Techniques for Analysis of Data: Several accounting ratios were computed in order to do a financial study of a chosen group of renewable energy enterprises. Liquidity, solvency, profitability, and other accounting ratios were used in the financial performance analysis. Using SPSS 20.0 and the t-test and statistical description, the hypotheses were examined in accordance with the study's requirements.

VI. Results and Discussions

The majority of the financial structure for India's renewable energy sector is made up of financing. Among the financing alternatives are commercial banks, venture capitalists, and private equity investors. This study examines the financial performance by considering the top three producers of renewable energy in India.

Table 1- Liquidity Ratios of Renewable Energy Companies

Year	Adani Green Energy Ltd.		Reliance Industries Ltd Green Energy		Tata Power Company Ltd	
	Current Ratio	Quick Ratio	Current Ratio	Quick Ratio	Current Ratio	Quick Ratio
2017-18	0.62	0.34	0.59	0.39	0.55	0.50
2018-19	0.77	0.72	0.73	0.52	0.74	0.68
2019-20	0.86	0.82	0.63	0.45	0.88	0.75
2020-21	0.67	0.67	1.34	1.05	0.84	0.71
2021-22	0.52	0.49	1.12	0.78	0.80	0.57

Source: Data taken from Annual Financial Statements of Sample Companies

The table 1 shows the liquidity position of selected renewable energy companies of India. Adani Green Energy Ltd maintains stable current ratio during the study period as it was 0.62 times in 2017-18 which reached to 0.52 times in 2021-22. The quick ratio of the company was only 0.34 times in 2017-18 which was reached to 0.49 times in 2021-22. The company demonstrated strong financial stability and ideal/stable liquidity, ensuring that its stakeholders will have enough money on hand to cover current obligations and working capital. Reliance Industries, in contrast, maintained a constant quick ratio and high liquidity throughout the research period. Throughout the research period, Tata Power Ltd. also maintained a healthy liquidity position.

Table 2- Solvency Ratios of Renewable Energy Companies

Year	Adani Green Energy Ltd.		Reliance Industries Ltd Green Energy		Tata Power Ltd	
	Debt Equity Ratio	Interest Coverage Ratio	Debt Equity Ratio	Interest Coverage Ratio	Debt Equity Ratio	Interest Coverage Ratio
2017-18	7.25	0.62	0.62	7.13	2.76	1.16
2018-19	12.73	0.48	0.70	4.34	2.68	1.14
2019-20	18.45	1.14	0.65	3.63	2.47	1.31
2020-21	27.22	1.14	0.32	3.33	1.85	1.84
2021-22	43.86	1.51	0.34	8.60	2.12	2.18

Source: Data Retrieved through Annual Financial Statement

Table 2 shows the solvency status of a few Indian renewable energy enterprises. Reliance and Tata Power Ltd. had a lower debt-to-equity ratio (i.e., 7.25) than Adani Green Energy Ltd. The majority of Adani Green Energy Ltd.'s income go toward paying interest since the company is more focused on debt. From the standpoint of the company, a higher debt-to-equity ratio implies that creditors have more claims, which is undesirable. On the other hand, low leverage/geared companies are Tata Power and Reliance Green Energy Ltd. They benefit from a strong equity component and a larger margin of safety. In the current climate of the Indian renewable energy market, it offers a viable funding structure.

Table 3- Profitability Ratios of Renewable Energy Companies

Year	Adani Green Energy Ltd.		Reliance Industries Ltd Green Energy		Tata Power Ltd	
	ROCE	ROA	ROCE	ROA	ROCE	ROA
2017-18	3.51	-0.87	11.42	4.41	9.88	2.93
2018-19	4.48	-3.23	10.45	3.94	8.52	2.79
2019-20	7.37	-0.12	10.62	3.37	9.44	1.13
2020-21	9.75	0.73	6.75	3.71	6.80	1.14
2021-22	6.57	0.82	8.02	4.04	7.22	1.54

Source: Data Retrieved through Annual Financial Statements

The earnings performance of Indian renewable energy companies is displayed in the above table. Adani Green Energy Ltd.'s return on capital utilized was 3.51% in 2017–18 and increased to 6.57% in 2021–2022. The return on capital employed for investors in Reliance Industries and Tata Power Ltd. is satisfactory. During the first phase of the study, Adani Green Energy's return on asset was negative.

Table 4- Statistical Description of Ratios

Ratios	N	Mean	Std. Deviation	Std. Error Mean
CR	15	.7773	.21884	.05651
QR	15	.6293	.18790	.04852
DER	15	8.2680	12.60550	3.25473
ICR	15	2.6367	2.41441	.62340
ROCE	15	8.0533	2.26881	.58580
ROA	15	1.7553	2.13680	.55172

Source: Calculated from the Data Retrieved through Annual Financial Statements of Renewable Energy Companies of India from 2017-18 to 2021-22.

The statistical breakdown of the overall financial performance of Indian renewable energy enterprises is displayed in the above table. The standard deviation, mean, and standard error of performance ratios for a subset of Indian renewable energy enterprises from 2017–18 to 2021–22 are all included in the statistical description. The fast ratio had a value of.62 and a standard deviation of.187, while the mean value of the current ratio was 0.77 with a standard deviation of.21884. With a standard deviation of 2.26, the mean value of return on capital employed was 8.05 percent, however the mean value of return on asset was just 1.75 percent with a standard deviation of 2.13.

Table 5- Results of t-test Statistics

Ratios	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
CR	13.757	14	.000	.77733	.6561	.8985
QR	12.972	14	.000	.62933	.5253	.7334
DER	2.540	14	.024	8.26800	1.2873	15.2487
ICR	4.230	14	.001	2.63667	1.2996	3.9737
ROCE	13.747	14	.000	8.05333	6.7969	9.3098
ROA	3.182	14	.007	1.75533	.5720	2.9387

Source: Calculated from the Data Retrieved through Annual Financial Statements of Renewable Energy Companies of India from 2017-18 to 2021-22.

The results of testing hypotheses using the t-test on various ratios of Indian renewable energy firms are shown in the above table. Based on the study, it is evident that all ratios have significant values below 0.05, indicating a notable variation in the liquidity, solvency, and profitability of a subset of Indian renewable energy enterprises. Since the significant value is less than 0.05, all of the null hypotheses that is, that there is no discernible difference in the liquidity, solvency, and profitability positions of renewable energy companies are thus rejected. As a result, it can be said that several Indian renewable energy enterprises differ significantly in terms of their liquidity, solvency, and profitability.

VII. Conclusion

The green energy producing companies in India are still struggling to find a stable environment. There is now a recession in the renewable energy industry. The many financial metrics demonstrate that the Indian renewable energy industry is trying to make a name for itself in the industry. The financial information of the three big companies mentioned above served as evidence for it. For Indian investors, the renewable energy industry in India has not proven to be a profitable venture. The majority of the money made by these companies is utilized to pay down the interest part of the debt, which is still supported by the debt financing model in India's renewable energy sector. Changes in funding policies are necessary to revitalize the renewable energy sector in India. We must promote the renewable energy market. The data indicates that while the renewable energy business in India is still in its infancy, there are more prospects for growth in the future. It thus offers a range of potential investment options to investors.

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