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RESEARCH ON THE FINANCIAL ASPECTS OF MANAGING RISKS IN THE RENEWABLE ENERGY INDUSTRY

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Abstract: To keep up with the needs of the booming global economy, energy is becoming more crucial. As awareness of environmental dangers and green technology increases, the argument over whether or not to use renewable energy sources has heated up. Increased understanding of how financial institutions evaluate risk is essential for attracting more investment in renewable energy sources. Considering the industry's infancy, a lack of knowledge might lead to an underestimation of risk, which could result in a failure to get financing or, if funding did materialise, financing on unfavourable terms that would reduce the site's ability to generate revenue.

Keywords: Financial aspects, risk predictions, renewable energy industry.

Introduction

The most essential natural resource for humanity is energy.[1] Energy is the fundamental building block of humans and a crucial component of a nation's socioeconomic growth, according to Satyanarayana (1989).[2]

So, there is no doubt that energy is the driving force behind the social and economic development of any country. Studies have shown a clear link between a country's per capita energy consumption and the standard of living of its citizens. So, it is redundant to stress the significance of the power industry to national development.

Energy is increasingly important to meet the demands of the expanding global economy. Using renewable energy has become a hotly debated topic as people's knowledge of environmental threats and green technology grows. Investment in renewable energy sources can only rise with a deeper knowledge of how lenders view risk. Given the industry's relative youth, incomplete information might lead to an underestimate of risk, which in turn could lead to a failure to get financing or, if funding were to materialise, funding under unfavourable terms that would hinder the site's potential to produce income. In India, it is standard practise to finance real estate projects for a period of 10–12 years at an interest rate of 12–13%, but in Europe and the United States, the financing time is 17–18 years at a cost of 4-5%.

Renewable Energy: Advantages and Disadvantages

The following list enumerates some of the benefits of renewable energy:

• As implied by the name, renewability is the main benefit of renewable energy. It won't run out ever. As opposed to traditional forms like oil, gas, and coal, which are scarce and quickly depleted, it is sustainable.

"“[1] Odum,H.T, and Odum E.C. (1985), Energy Bases for man and Nature London, Mcgraw Hill BookCompany, p7.

[2] Satyanarayana,K., (1989), Visualizing Future Power Demands. Yojana, Vol .XXXIII No. 17, p4.

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• The fact that renewable energy has no environmental impact is another important benefit. There are hardly any, if any, carbon or greenhouse gas emissions. According to the research, renewable energy technology emits very little greenhouse gas over its whole life cycle. Also, because sun and wind nuclear reactors do not need any water to function, they do not put a pressure on the water supply and do not contribute to water contamination. But the use and pollution of water by traditional technologies has a substantial negative impact on water supplies.

•In addition to the aforementioned advantages, the development of wind technologies has substantial economic advantages including the creation of jobs.

• Compared to traditional power plants, renewable energy facilities demand fewer maintenance and operating expenses.

• The creation of green energy projects may also result in price stability for energy, since the cost of energy is not based on the fluctuating price of land and resources like coal and other fossil fuels.

RE has the following shortcomings:

They have a strong site-specificity. For instance, low wind speeds prevent the construction of wind energy everywhere. Yet, India is fortunate to have a significant quantity of renewable energy potential. This drawback may be solved in a number of ways, including by carefully integrating and using multiple renewable energy sources.

As compared to traditional energy sources, the initial capital expense of wind farms is another significant drawback. The larger initial capex to O&M cost ratio suggests a very interestingness load to be met over the duration of the project, even though fuel prices are essentially zero and O&M expenses are minimal. As a result, riskiness is a persistent problem.

The poor voltage productivity (watt/sq. m) of renewable energies as comparison to nuclear and traditional coal-based power production is another drawback. 1-2 W/Sq.m for wind energy, compared to 3000–4000 W/Sq.m for coal and nuclear, is comparable to 25 W/Sq.m for solar energy.

Unlike traditional technology, which is dependent on fossil fuels, green energy technologies, such as solar, etc., can need a great deal of land.

Risk & Risk Management

"Risk" Definition We can prevent danger in any sector.

Many definitions of "Risk" have been offered in literary works. The definition of risk is "the likelihood of danger, loss, or damage."

Another definition of risk is "danger, probability of a bad result, loss, exposure to the chance of harm or loss."

Another hazard is the variety of effects that may occur within that situation.

The Handbook to the Domain of Research for Project Management defines risk as "an unexpected event or situation that, if it occurs, has a favourable or unfavourable influence on even a project target."

Generally speaking, the concept of risk consists of three elements: consequences (which may be favourable), the impact on physical or immaterial wealth, the possibility of an occurrence, and the specific circumstance where risk may exist.

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Rivza S. and Pilvere I. (2012) divided the various risk meanings into the following three groups.:

1. A definition that excludes potential effects in favour of a probability-only emphasis
2. Definitions that include repercussions, such as whether they are solely good, solely negative, or both positive and negative.
3. Concepts that include both probability and consequence.

They used the following definition of risk: "Risk is the dual of the probability of an event happening and the magnitude of any potentially negative effects."

Risk is defined as "the unfavourable influence that unclear estimations may have on the financial worth of an endeavour or investment" with specifically deal in renewable energy projects. In fact, risk is the exact opposite the upward potential. As a result of shareholders' aversion to risk, risk plays a big role in investing choices.

According to one meaning, the phrase "financial risk" is used to refer to a wide range of dangers connected to finance.

The following risk is crucial to this investigation: "Loss is a possibility, which is risk. It might be seen as a phenomenon that affects emotional responses in people."

The aforementioned concept is crucial to our research since risk has traditionally been seen as a psychic state based on logic, which might change for different people or organisations.

The word "risk" is often used to describe a potential bad thing, such an unclear financial future or investment return. The analysis of older literature revealed that "risk" and "uncertainty" are commonly used interchangeably. When it is known how probable each consequence will be, the word "risk" is often used; but, when it is unknown how likely any circumstance will be, the term "uncertainty" is frequently used.

administration of risk While risk cannot be completely eliminated, it may be generally decreased with effective management. The reduction of risk's financial effect is the goal of the risk management approach. If a risk cannot be totally removed, risk management is crucial to keeping it within acceptable bounds.

Risk management is defined as "the process of detecting risks and choosing and managing techniques to react to risk exposures" and is "a sophisticated notion and a continual endeavour."

There are two phases of project risk management, and they are:

1. Risk Evaluation
2. Risk Controll

Every one of the previously mentioned stages have different sub advances:

Risk assessment It consists of

Clearly visible evidence of risks

examination of risks

the order of dangers.

Risk Management: The stage includes the following four substeps:

Risk Reduction Risk Planning

Convention for Risk Register and Risk Letters.

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Quality management is defined as "a systematic method to identify billable and – anti risks, assessing the possibility of loss against with the healthcare costs and lowering the chance of loss by really well constantly complied processes and procedures," in another definition.
The cycle of risk analysis is still in place, and corporate governance is an ongoing process.
The Portfolio Management Cycle consists of four essential phases:
a) Defining the objectives and contents
b) Risk identification;
c) risk assessment; and
d) ultimately, risk management actions are put into action..
Risk checking and counteraction are to be carried out at all phases of the cycle.
It is crucial to understand the RE Supporting's focus areas right now. Funding a project for conventional energy is quite different than supporting a project for renewable energy. As financing is a brand-new idea that needs new explanation, it is important to keep in mind the venture-dynamic route of lenders RE. The difficulties with budgetary design and the fact that RE projects often have large upfront costs and low functional costs make this situation worse. It shows that more sustainable energy projects have greater speculative costs than usual. For instance, the speculative cost makes up around 80% of the entire cost of a wind project, but it is more like 15% for internal combustion.
So, the bulk of the project should be finished before the framework is put into use. This raises the venture likelihood of the job. Today, the cost of borrowing will rise if the revenue to gdp consider the program to be hazardous. The cost of capital is a key aspect in deciding whether or not the attempts are financially sustainable, which has an impact on the objectives that have been defined given the money nature of the project. A dangerous notion of agents is produced more lately by a short history of designers. Normal employment must battle with RE for patronage, and traditional energy projects have a propensity to minimise risk. The risk and its judgement may be managed, which might greatly lower the cost of capital.
Lattice RE makes it easy to gauge return via surveys but difficult to control risk.
Cleaner power sources have inspired strategies via innovative improvement and support initiatives. To ensure that the rise of environmentally friendly power is managed, it is essential to ensure that executives have appropriate protection tools and other risk-taking instruments. Yet, the risks connected with green energy initiatives are also getting more complicated.

Indian Power Area: Current Situation and Difficulties

Current Situation

Power area is one of the pivotal part of India's Foundation . Throughout recent many years or more, India has accomplished critical advancement as far as upgrading the age of force and in its endeavors to make power accessible both for homegrown requirements and for financial improvement with a target of maintainability and ecological worries. As far as wellsprings of Force Age, power area of India is extremely broadened. All wellsprings of producing power right from traditional (coal, oil, atomic and so on) to non customary like breeze, sun based, bimass and so on are utilized.
Following table shows the complete Power age introduced limit as on 31st Walk 2021 in India[3]:

"[3] Ministry of Power, Government of India (2016). Power Sector at a Glance All India .Retrieved,25.04.2016

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Table 1.1: As of the 31st of March 2016, the total capacity that was operational for power generating

Fuel	MW	Percentage
Total Thermal	211420	69.81
Coal	185993	61.42
Gas	24509	8.09
Oil	919	.3
Hydro(Renewable)	42,783	14.13
Nuclear	5780	1.9
RES(MNRE)	42849	14.15
Total	302833	100

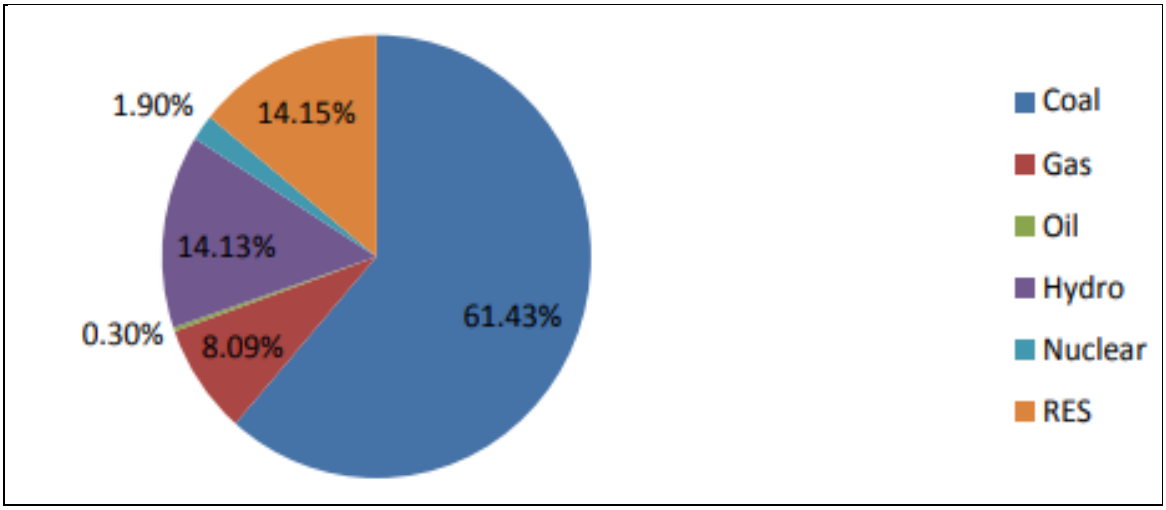

Figure 1.1 shows gigawatts as of March 31, 2021, broken down by generating mix.

By providing more than 60% of the nation's electricity, coal may be viewed to be the mainstay when it comes to energy production.

The following table displays the growth in power capacity across several five-year planning periods[4].

from http://www.powermin.nic.in/:

"[4] Central Electricity Authority (2014). Retrieved 21 .03.2015 from **www.cea.nic.in**:

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Figure 1.2 shows the growth in power capacity across several five-year programmes.

The Indian power industry expanded by 8.4% on a yearly basis in the 2015 fiscal year. Under the twelfth five-year plan, the highest power generating capacity ever was installed.

By increasing capacity and enhancing transmission, the gap was significantly reduced from 6.3% in June 2013 to 3.6% in 2014–2015 and even lower 2.6% in 2015–2016[5]. As a result, it is clear that India's electricity industry has advanced considerably.

There is, however, another facet to this. Despite a recent uptick, India has one of the world's lowest rates of energy use per person. Per capita electricity consumption in India was 915 kWh in 2012–2013, 957 kWh in 2013–2014, and 1010 kWh in 2014–2015, as reported by the CEA (the Energy Regulatory Authority), compared to 4500 kWh in China and 15,000 kWh in industrialised nations. However, today, there are still over a quarter of a million houses without access to electricity. This percentage is about 30% higher than the national average in certain eastern and north eastern states.

In India, there are over 280 million people without power. Yet, there is a shortage of energy that is rapidly shrinking. Despite the increase of capacity of about 20 GW, it is predicted that there would likely be an energy shortfall. One of the biggest obstacles to India's growth is reportedly a lack of electricity. Indian businesses have long seen the pricey and inconsistent electricity as a major impediment to growth. So, in order to support economic growth, electricity must be provided from a stable and cost-effective source. The nation's expanding population makes this issue even more challenging.

By 2020, it is anticipated that there will be a need for around 1640 billion units of energy, which would necessitate a significant increase in generating capacity from the current level[6].

[5] Central Electricity Authority (2015). Load Generation Balance Report 2015-2016. Retrieved.04.05.2016 from http://www.indiaenvironmentportal.org.in/files/file/lgbr_report.pdf:

[6] Central Electricity Authority (2015). Load Generation Balance Report 2015-2016. Retrieved.04.05.2016 from http://www.indiaenvironmentportal.org.in/files/file/lgbr_report.pdf:

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Figure 1.3: Energy demand forecast

According to European Panel (2016), it is estimated that with 8% annual economic growth, the country's absolute energy need would rise to 1351-1702 MTOE, or Billion Tonnes of Oil Equivalent. It is estimated that up to 90% of the oil, half of the combustible gas, and 11 to 45% of the coal would be anticipated to be imported given the pace of domestic production of coal, petroleum gas, and oil in the presence of various constituents.

Sun powered Energy: A Confident Industry

Sun powered Energy is viewed as a promising industry inside the RE crate. Somewhere in the range of 2016 and 2021, introduced limit in the sun oriented area expanded from 18 MW to 5000 MW, showing its unstable extension. The public authority's enthusiasm and drive are obvious in their correction of the point from 20,000 MW to 100,000 MW. Coming up next are a few essential purposes behind considering clean power a likely industry:

In India, sun powered energy has the most potential famous sustainable power sources. India is arranged between the Jungles and the Equator, between scopes of 8°4'N and 37°6'N, and longitudes of 68°7'E and 97°25'E.

India has a lot of daylight and normal temperatures somewhere in the range of 25 and 27.5 degrees Celsius on the grounds that to the subcontinent's lucky position. India has a normal of 300 bright days out of each year and gets 200 W/M2 of sun oriented radiation yearly, as indicated by an IEA report from 2021.

As indicated by the India Energy Gateway, sun oriented energy can be delivered on around 12.5% of India's whole land region.

India gets sun oriented energy each year that is equivalent to 5,000 trillion kWh.

Table 1.4: Seat marks capital expense per MW in Rs Cr

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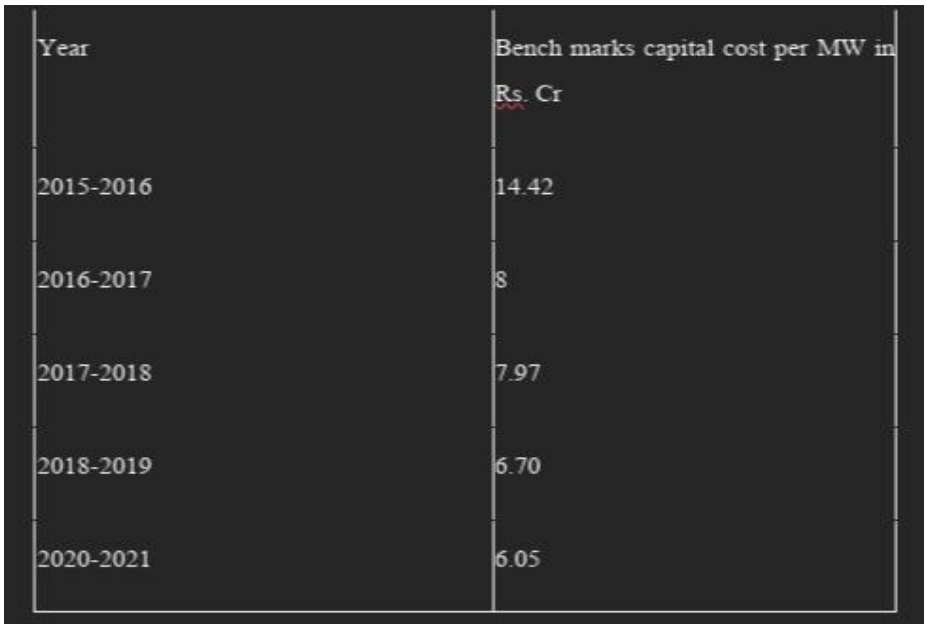

Year	Bench marks capital cost per MW in Rs. Cr
2015-2016	14.42
2016-2017	8
2017-2018	7.97
2018-2019	6.70
2020-2021	6.05

As indicated by the Sun Asset Guide of India distributed by NREL, the yearly DNI (Direct Ordinary Irradiance) is more than 5KWh/m2/day across most of India (58%). The territory of MP, Maharashtra, and Chhattisgarh all have sizable locales with yearly normal DNIs more than 5.5 KWh/m2/day, as per the guide. This could go somewhat of a way towards proficiently and economically providing the developing interest for power.

The benchmark cost of a sun oriented power plant has fundamentally diminished[7].

Hence, it is evident that the Benchmark Cost of solar generators has significantly decreased. Costs were cut by 15–16% in 2015–2016 and 9.68% in 2016–2017 compared to the prior year. The cost of PV modules has decreased significantly. Pricing reduction since 2012 is 80%.

With time, the cost of solar energy has also greatly decreased. From Rs. 17.90 per unit in 2010 to Andhra Pradesh's most recent proposal of Rs. 4.63 per unit. With coal-based electricity often costing approximately Rs 3 per unit, it is fairly reasonable to say that solar power is on the verge of reaching grid parity. According to reports, the cost of capital has decreased, and equipment costs for modules, inverters, and the balance of the plant have decreased by between 40 and 50 percent during the last three to four years.

In actuality, the cost of solar photovoltaic generating is cheaper than natural gas-based generation.

• The solar power market is gradually maturing without greater than 5000Mw of installed capacity.

• In addition to the aforementioned benefits, solar energy also offers zero fuel costs, extremely cheap O&M costs, and of course no negative environmental effects. While India stands third on the list of countries that generate the most greenhouse gases, just behind the US and China, environmental concerns are growing.

• Considering solar and peak demand, increasing the share of solar will also help the demand-supply balance.

"[7] Tyagi, A. P. (2009). Solar radiant energy over India. India Meteorological Department, New Delhi,India.

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•The government has recently begun to place a lot of emphasis on solar electricity. To meet a goal of 20GW by the year 2020, an extremely ambitious JNSSM was started. Also, a number of additional governmental initiatives, like as the FIT system and RPO impositions, are being implemented to support the solar industry. For Grid-connected RE projects, the 12th Five-Year Plan established the following Goal[8].:

Table 1.5: Target in 12th five year plan for Grid Connected RE projects

Wind Power	11000 MW
Biomass Power Bagasse Co-generation	2100 MW
Biomass Gasifies	
Small hydro	1600 MW
Solar Power	3800 MW
Total	18500 MW

The government intended to expand the contribution of solar within investment opportunities to the level of 20% of the completed capacity of RE projects, as can be seen from the above-mentioned established objectives. The government's passion for boosting the solar industry is now evident in the recent modification of objectives for this industry to 1,000,000MW. Of of this, 40 GW are intended to be produced by roof-top grid interactive initiatives, and the remaining 60 GW through ground-mounted grid linked mechanisms. In addition to establishing these goals, the ministry (MNRE) has also established year-by-year objectives to track success. The government supports solar developers in a number of ways. The government is making an effort to assist them, even with financing. The RBI has included the renewable energy industry to its list of priority industries for financing. The following categories may be used to group financing institutions that are lending money to solar energy developers[9]:

[8] Planning Commission of India (2012. January). Report of the Working Group on Power for TwelfthPlan (2012-17). Retrieved on 31.01.2016 from www.planningcommission.gov.in: http://planningcommission.gov.in/aboutus/committee/wrkgrp12/wg_power1904.pdf

[9] Adhana, D. K. (2015). SOLAR ENERGY MISSION: PAVING THE WAY FOR INDIA'S TRANSFORMATIONAL FUTURE. International Journal of Advanced Research in Management and Social Sciences, 4(12)."

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Fig. 1.4 classifies the financial institutions that provide money to solar energy companies

The condition of risk managment is one of the significant obstacles that must be solved in order to meet the renewable energy objectives.

Conclusion

When it comes to power, renewable sources have replaced all other options. That is, in fact, the only way to keep from starving. One may make the case that renewable energy technology' benefits will outweigh their costs eventually, if not now. Constraints and drawbacks will, without doubt, be eradicated in the near future as a result of technological developments and ongoing research in the industry.

The investment required to adapt to new RE technologies is substantial. More effort is required to bridge the investment gap between the current level and the desired level. An undertaking's risk-reward profile is a primary consideration for investors. They consider the severity of each potential problem and the methods that may be used to lessen it. Thus, this factor must be carefully studied if the use of renewable energy sources is to rise dramatically.

India's energy policy is based on two pillars: rapid economic growth and universal access to modern energy sources. But, increasing the quantity of renewable energy to a very high level is the only way to achieve these targets right now, especially considering India's vast renewable energy potential. Renewable energy only accounts for 14% of total power generation, so even while the growth rates are positive, more attention is clearly required for enhanced development. When properly implemented, solar has the most unrealized potential among the many renewable energy sources and has the ability to greatly contribute to the nation's energy security.

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