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Implementation of renewable energy technologies in India and associated barriers: Stakeholders' perspective

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Abstract

India is a developing country and requires energy sources that can satisfy the energy requirements and generate less carbon as the world is going through a carbon crisis. India is converting itself to a user and producer of Renewable Energy (RE). But on following this road map a lot of barriers are faced by various stakeholders. The idea of 'One Sun, One World, One Grid' was addressed by Prime Minister Narendra Modi who states that 140 countries will be connected through a common grid that will be used to transfer solar power. This mantra 'The Sun Never Sets' makes it more important for us to strengthen our renewable energy even more to make better use of it. To solve the barriers, it's important to know about the perspectives of various stakeholders and the barriers they face. In technology implementation, there are various stakeholders involved such as the Government in making standards, laws, and rules, Vendors in providing the technology, and the client itself who is the final consumer of the technology. Considering the same, this paper outlines various barriers commonly faced by stakeholders in implementing renewable energy technologies.

Keywords: Renewable energy, solar energy, prime minister schemes, grid, carbon emissions, fossil fuels

Introduction

India is the 3rd largest energy gobbling country in the world, and it is ranked as 3rd renewable energy country attractive index in 2021. By the end of 2022, India has set an aspiring target of achieving a capacity of 175 GW worth of renewable energy. Also, India has planned the world's largest expansion in renewable energy which is expanding by 500 GW by 2030.

With the addition of 13 GW in 2021, India is ranked third globally and has the second-largest market in Asia for new solar PV capacity. For the first time, India has overtaken Germany (59.2) with a total installation of 60.4 GW and ranked fourth. With the entire non-fossil based installed energy capacity of 159.95 GW which is 41.4% of the total installed electricity capacity, India has achieved its Nationally Determined Contribution (NDC) targets.

Including large Hydro India's installed renewable energy capacity has expanded by 396% in the last 8.5 years and stands at more than 159.95 Giga Watts, (as on 31st March 2022) which is about 40% of the country's total capacity. As of 1st June 2022, in the last eight years, the installed solar energy capacity has escalated by 19.3 times and stands at 56.6 GW. Including large hydro, the installed renewable energy capacity has expanded from 76.37 GW in March 2014 to 159.95 GW in May 2022, i.e., an overall expansion of around 109.4%.

India has a combined installed capacity of 163 GW of renewable energy including large hydropower (as of 31st August 2022).

Table 1: below represents the installed capacity for renewable energy in India as of 31st August 2022.

| Renewable Energy | Installed power (GW) |
|-----------------------|----------------------|
| Wind Power | 41.2 |
| Solar Power | 59.34 |
| Biomass/Co-generation | 10.2 |
| Small Hydro Power | 4.88 |
| Waste to Energy | 0.47 |
| Large Hydro | 46.85 |

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Government Commitments on reducing carbon emissions

India has set an aim of reducing carbon emissions by 1 billion tonnes by 2030. By the end of the decade, India has set the goals of reducing the carbon intensity of the nation's economy by less than 45% and attaining 50% cumulative electric power installed by 2030. India has also set the target of achieving net-zero emissions by 2070. By 2030, India could build a market worth up to \$80 billion.

By 2030 India has a target to produce 5 MT of green hydrogen which has the capacity of reaching 8 GW per year by 2025. The collective value of green hydrogen market could reach up to \$8 billion by 2030 in India. For shooting up the hydrogen production India will need at least 50 GW of electrolytes.

Review of Literature

In a study titled "Implication of theory of planned behaviour and marketing mix variables in assessing the mindset of consumers for solar products in India", Alam, Fathima (2022) ^[1] studied the frame of mind of Indian consumers concerning solar products. This study focused on escalating knowledge about the perception of Indian consumers regarding solar products. Also, it assisted the social marketers in concentrating on their thinking and activities, which in turn will help policymakers, people and professionals distressed with the social marketing aspect. This study has accomplished connecting people with solar products for the enhancement of society.

In a study titled "Role of Managers and Stakeholders Perception on Solar Technology Adoption Intention: A case of Micro, Small and Medium Enterprises (MSMEs) in Lagos State, Nigeria", Ajah, Pathranarakul (2021) ^[2] studied that the influence of frame of mind/perspective from Theory of planned behaviour (TPB), Disruptive Innovation Theory (DIA), understanding, opportunity, and barrier over managers (owners) of MSMEs intention to accept solar technology for their businesses. The results reflected that frame of mind/perspective, (DIA) and opportunity have a remarkable influence on solar technology intent. However, awareness-knowledge and barriers were not noteworthy. In addition, the study showed that Disruptive Innovation Theory was found to

have an outstanding effect on the opportunity, barrier, and frame of mind/perspective however, the barrier on mindset/attitude was not significant.

In a study titled "Barriers to Overcome in Accelerating Renewable Energy Penetration in Bangladesh", Mahmud, Roy (2021) ^[4] studied national-level barriers depending on one another with an outlook to greater understanding in what order they can be approached to conquer them. The study showed that the preference is the need to reevaluate the ongoing top-down process in policy and governance in the energy sector in Bangladesh. By making space for new institutional organizations and the critical role of local experts, stakeholders such as businesses, manufacturers, and users can build a socio-political environment that makes it feasible to break the ongoing interlinked series of barriers. Reconsidering the present-day fuel-specific design and allocation of subsidies and the tariff structure is necessary.

Aim and Objectives

To identify the barriers faced by stakeholders (Vendors, Government and Customers) in implementing renewable energy technologies in India.

Research Methodology

For this research paper the data was gathered from different stakeholders that is Vendors, Government and Customers. Purposive sampling technique was used to select the stakeholders for the study. Primary data was collected using questionnaire and personal interviews. The data obtained were analysed qualitatively as per the objectives of the study.

Result and Discussion

Vendors

Vendors are the suppliers of Renewable energy. They are the ones in direct contact with the customers. Vendors not only manufacture such technologies but are also responsible for dealing with various clients' issues, problems, and feedback. Considering this, they form one of the most important stakeholders as they bridge the gap between technology and the client. Below are some barriers that vendors face while implementing renewable technology.

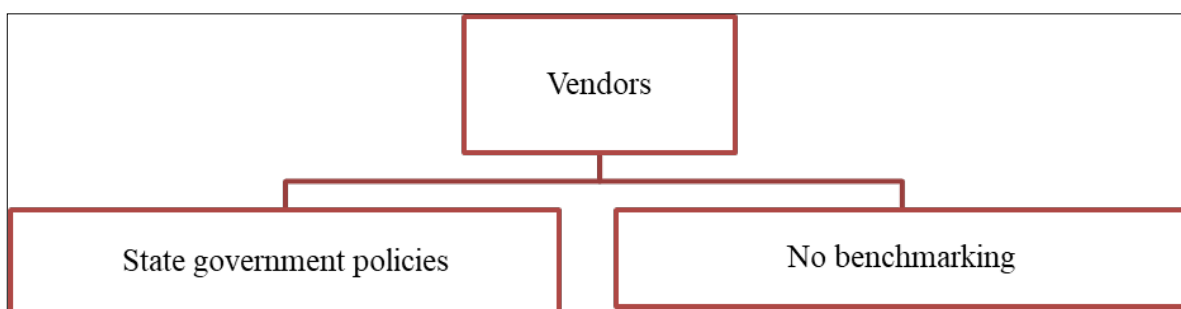


Fig 1: Barriers Faced by Vendors

- State government policies should be revisited and looked at for better adoption of the technologies.
- No benchmarking, no standards concerning the development, implementation, and care & maintenance of the renewable energy plant is a huge barrier as there are no standardized criteria to which the actual performance

could be compared.

Solutions proposed

- There should be awareness about renewable energy and how it can reduce its Capex and apex.
- State governments should monitor plant data and rate solar plants to bring out crucial facts and information.

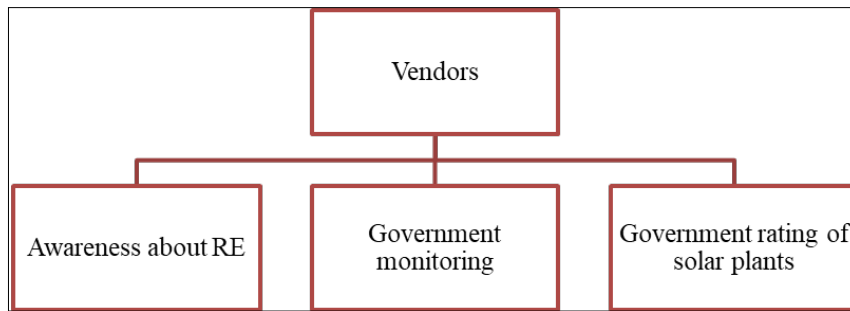


Fig 2: Solutions Proposed for Vendors

Government

The role of government can't be neglected concerning renewable energy as it develops and deploys new and existing renewable energy rules, regulations and policies. Government policies and schemes play a very crucial role in the development of the renewable energy sector in a country. The

government is the main policymaker assisting everyone else's work. Also, they drive the market as they are the ones deciding if the technology is cost-effective. Considering the same, the government also faces a lot of barriers. Below are some barriers faced by the government while implementing renewable technology:

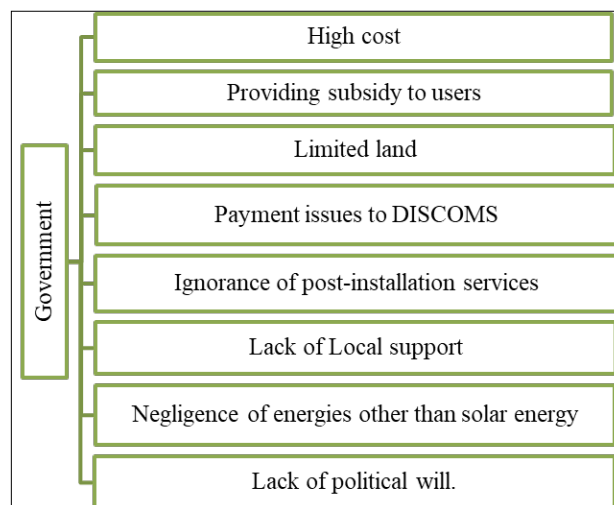


Fig 3: Barriers Faced by Government

- High initial and transaction cost of technology.
- Addressing the need for subsidy– Every citizen needs subsidy, but it is limited and cannot be given to all. So, it's important to come up with a mechanism to handle this issue so that people can stay motivated for implementing renewable energy technology.
- Limited land – For massive plants, there is a need for a larger area of land but there is restricted land to work with.
- The power purchase by (Distribution Company) DISCOMS and payments on time should be ensured
- Ignorance of post-installation services – Suppliers normally pay little attention to post-installation services which lead to the failure of the plant.
- Power connectivity and local support are important factors that determine the rate of adoption of renewable energy technologies. This must be considered and given the right weightage.
- Solar energy is given more focus in this field other energies are neglected.
- The political will to encourage such technologies is not there.

Solutions proposed

- There should be strict compliance by the DISCOMS or Purchasing Agencies/State Governments about renewable energy technology.
- It is suggested that the government should focus on skill development and capacity building. National Power Training Institute is one such body providing skills in the field of energy. This should be made available to people for building capacities.
- The modification in existing policies and the framing of more policies conducive to the RE development regime is required.
- Building digital solutions to minimize and strengthen the adoption of renewable technologies could be of great help.
- The government should come up with incentives for implementation of RE technologies other than solar energy.
- There should be more expenditures in Research & development.

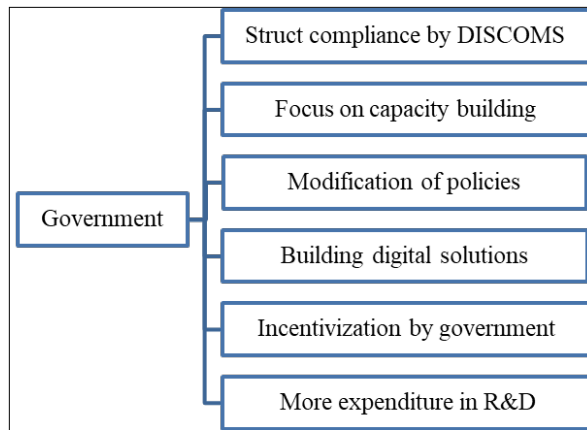


Fig 4: Solutions Proposed for Government

Customers receive the final output from the technology. They use and misuse the product. They are the ones getting the benefits and facing the challenges on a day-to-day basis.

Hence, it's very important to know the challenges faced by them. Below are some barriers faced by customers while implementing renewable energy technology:

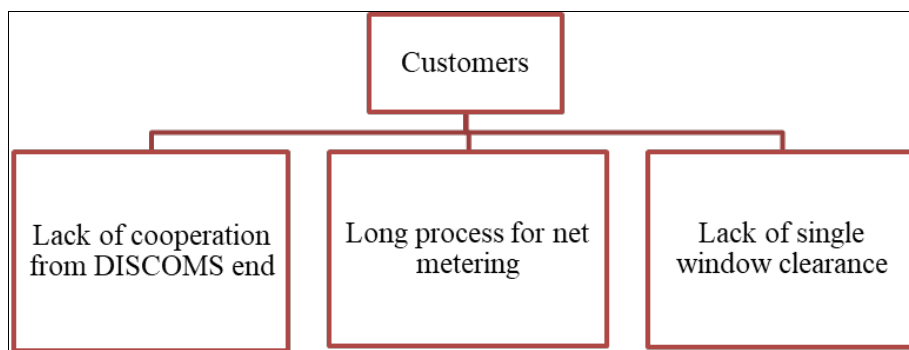


Fig 5: Barriers Faced by Customers

- Lack of cooperation from DISCOMS end.
- Net metering clearance is a long process.
- Single window clearances not available. To install a Renewable system, there are multiple levels of clearances and approvals that need to be sort by the consumer. This works as a deterrent for implementation.

Solution proposed

- Large scale mobilization needs to be adapted. All stakeholders need to be on the same page with renewable energy technology.
- There needs to be a single-window clearance for the installation of solar plants and net metering.

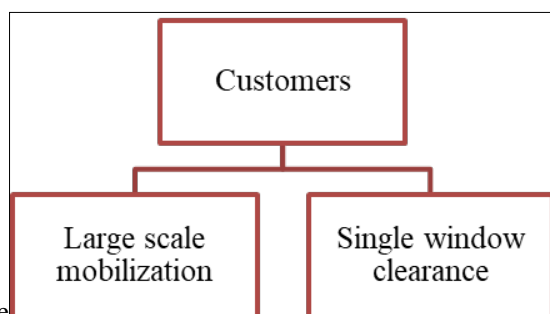


Fig 6: Solutions Proposed for Customers

Others

A few perspectives of various other stakeholders came out in the picture. These stakeholders were Green Building Rating Agencies, Researchers, Advisors, and International Organizations etc. The points highlighted by these

stakeholders are listed below:

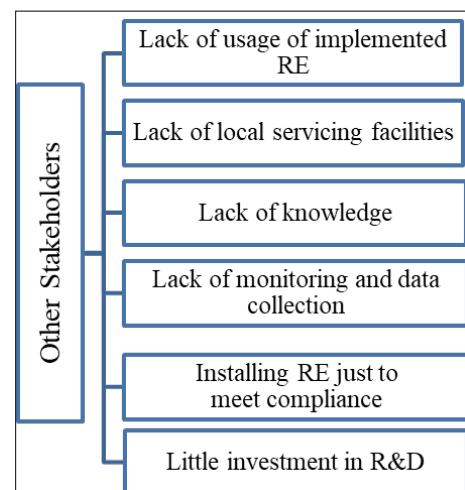


Fig 7: Barriers Faced by Other Stakeholders

- The green building rating agency reported, there is a lack of usage of the renewable energy technology once it is implemented.
- The researchers reported, there is a lack of local servicing facilities for renewable energy technology as in the case of solar agricultural pumps.
- It was brought into the notice that during the construction phase of the building the owners don't think about integrating renewable energy technology to the building which poses a major problem at the time of implementation of the technology. Once the technology

is put into place it is difficult to keep a check on aftercare because vendors have limited capacity.

- Lack of knowledge on efficient use of energy is another barrier. The training and knowledge-sharing about energy efficiency is the most important aspect which isn't taken care of. There is not only a lack of information but there is a lot of misinformation about policies and incentives.
- There is a lack of monitoring and data collection after the implementation phase is completed. The data is the key to preparing case studies to educate others about the dos and don'ts of technology usage.
- Another concern is State government policies limiting Renewable deployment to protect existing coal assets.
- While some projects go beyond just meeting compliance, most clients only install the Renewable systems to meet compliance.
- There is little investment in Research and Development.

Solutions proposed

- Loan availability for renewable energy technology should be given a chance for more acceptance and implementation of the same.
- Integrating renewable energy in buildings or housing societies should be planned at the designing stage. This will help in the selection of the right technology and its specifications.
- Documentation should be done at different stages starting from selection, installation, and use of technologies.
- The power system should be reshaped to be more decentralized (mini-grids, Demand side management, etc.) and shift stakeholders away from centralized, fossil fuel power system models.
- Better outreach so common men know the benefits of Renewable systems along with the policies and incentives available.

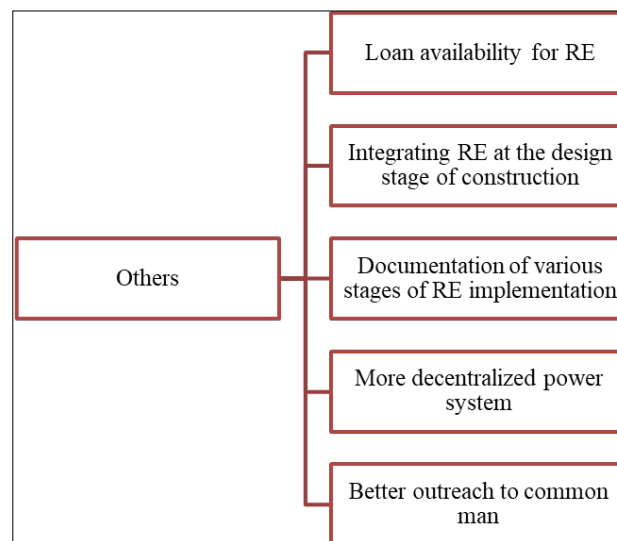


Fig 8: Solutions Proposed for Other Stakeholders

Conclusion

India has a vast potential for generating renewable energy on a large scale. Even after being a solar abundant country, it depends up on Conventional sources of energy for implementing various tasks. So, it is crucial to study the barriers faced by various stakeholders at different levels rather than only focusing up on developing renewable energy technologies. After doing a thorough study, it can be said that there are various barriers faced by stakeholders that restrict renewable energy technologies from flourishing in India. This study has made a clear distinction between the barriers faced by Government, Vendor, Customers, and other stakeholders. It can be concluded that most stakeholders face issues regarding the standardization and aftercare processes. Also, the study pointed out that another important barrier is high cost and lack of access to sufficient information for the stakeholders. Along with barriers, the solutions were also proposed and one such important solution was to have a Single-Window Clearance. Another important solution is capacity building for the implementation and after the implementation phase. Removing these barriers and adopting these solutions will lead to wide adoption and acceptance of renewable energy technologies.

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