



ORIGINAL RESEARCH PAPER

Management

IMPACT OF RENEWABLE ENERGY ON INDIAN RURAL AREAS: A STUDY AFTER POST INDEPENDENCE ERA

KEY WORDS: Renewable energy resources, solar energy, rural India, NGO, Government policy

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ABSTRACT

This study discussed about the impact of renewable energy resources at rural India as the renewable energy is regarded as the significant alternative energy resources in India. The background of this research included the distinction between rural and urban India, renewable energy scenario, its challenges and opportunities, phases of renewable energy resources for last ten years and the role of public and private organizations in this regard. This study aimed to investigate the influence of renewable energy among the rural consumers and the barriers and challenges had been discussed with the help of NGOs and government officials. In the research methodology chapter, seven hypotheses had been developed. This study adopted descriptive research method, deductive research approach and survey research strategy. Data collection procedure included sampling plan of the study which followed probability and non-probability sampling both. For qualitative study, 15 sample sizes had been taken where the inclusion of 10 people from NGO and 5 government officials provided significant data in terms of scenario and challenges of renewable energy resource in the stages of implementation. According to the findings of the study, it was found that poverty, education, employment creation, good social life and socio-economic influences have high positive correlation and were impacted due to the adoption renewable energy resources in rural India. Further, the findings of qualitative research showed that there is lack of renewable energy initiatives in India and Government and local bodies have not been supportive much towards renewable energy initiatives. It can be recommended that better renewable energy initiatives should be adopted, by NGOs however it would not be possible without the support from Government and local bodies. Further, better technologies can be adopted, which would enable the organizations to provide efficient initiatives.

Introduction

1.1. Renewable energy scenario in rural India

In the present time, India has become the global leader in context of extensive renewable source of energy. Various schemes of renewable energy has started in the country, which includes various energy resources such as, wind energy, biomass, hydropower, solar energy, and other emerging technologies. The yearly turnover of the renewable industry in India is measured around US\$ 10 Billion (Saxena, 2013). More emphasis is put on improving the efficiency of renewable energy schemes and programs and towards minimizing the cost of investment. Apart from serving the economic progress of India, the programs of renewable energy have supported various rural folks through fulfilling the cooking and the energy needs. India has also started to offer the technical expertise in various other countries in order to promote the sources of renewable energy (Sargsyan, G., Bhatia, M., Banerjee, S. G., Raghunathan, K. and Soni, 2010).

Wind Energy- Government of India has establishing the wind farms in the regions of Gujarat, Orissa, Maharashtra, and Tamil Nadu. Bharat Heavy Electricals has also developed the wind energy machines, which holds the capacity of 200 MW. This technology is actually adopted in the private sector and it's expected that it will help in generating indigenous source of energy. In the 7th plan period, it's noted that around 2500 wind machines were established in the rural regions of these states; during 8th plan the target was to install around 100 MW pumps (Sargsyan, G., Bhatia, M., Banerjee, S. G., Raghunathan, K. and Soni, 2010).

Solar Energy- In most of the year, there is a plenty of sunshine in India; therefore, solar energy is in abundance. Hence the potential of using the solar energy is becoming popular. It's a very cheap as well as easy way of having the source of energy. In Rajasthan rural areas, a thermal power plant is already set up that is expected to become functional in some time (Palit, D., Malhotra, S., Pandey, M. K. and Bankoti, 2015). This is an achievement for the country and will support in rural development for long period.

Bio-gas- Biogas source of energy is mainly produced from the cow-dung that is mainly available in rural parts of India. It could be easily set up and is popular source of energy is regions like Tamil Nadu, Uttar Pradesh, Maharashtra, and Andhra Pradesh. Biogas is

mainly used for cooking purpose. In the 7th plan period, around 1500000 plants of biogas were established and is expected that in 8th plan, 750000 plants will be set up (Ahn, S. and Graczyk, 2012). Solar Photovoltaic cells- This implies the electrification of the rural regions of India, where electricity problem is the major concern. In the rural areas, source of conventional energy is made available through the help of generators having the capacity of around 10 to 100 Kw (Goswami, 2013). Bharat Heavy Electrical as well as central electrics Limited has come forward with the photovoltaic cells on the huge scale.

1.2 Rural society

Access to energy services is the major element of reducing the poverty as well as the indispensable component of sustainable development of human. Around 45% of the total population of the country is presently denied from energy access (Kulkarni, S. H. and Anil, 2014). In India, around 70% of the total population resides in rural regions and agriculture is the key support of livelihood (Kulkarni, S. H. and Anil, 2014). Therefore, it is ironical that rural population of the country shares the huge poverty burden along with poverty of energy.

Lack of energy access and its effect on the human welfare cover up the health of both children and women; income and education continues to be the important reason behind the poverty in rural India. Increasing energy access to the poor people in rural areas is the complex challenge for planners and practitioners to develop the areas (The Energy and Resources Institute Energy and Environment Data Directory and Yearbook, 2013/14, 2014). In spite of various initiatives taken by government of India policies in the present time, the significant progress is increasing the national grid and is trying to scale up the decentralized generation models by using the renewable energy, but the challenge is still continues.

1.3 Challenges and opportunities

Providing access to the adequate energy to the population of India is really a challenge. India is the developing country, in which energy consumption as compared to other parts of the world is low. In the year 2004, the estimated yearly energy consumption was 330 Million Tones Oil Equivalent (Palit, D., Malhotra, S., Pandey, M. K. and Bankoti, 2015). It's noted that power transformer technology in the country is quite impressive in last

five decades. There are many manufacturing in both public and private sector, which are accessing the latest technology at the international level. There are many manufacturers who have set up research and development for supporting the technology for generating more renewable energy (Ahn, S. and Graczyk, 2012)

2. Literature Review

2.1 History of Renewable Energy in India

The government of India has embarked an ambitious plan like Jawaharlal Nehru National Solar Mission which intends to build 20,000 MW of solar power nationwide by 2020. The challenges of the renewable energy sector in involved in India's overall infrastructure financing. According to the Planning Commission of India, infrastructure investment is expected to increase from about 10% of GDP by 2016-17. In 2017, due to lack of long term finance, the Indian government estimates 30% gap of infrastructure investments. During 2007 to 2011, wind capacity installations of India has increased at a compound annual growth rate of 19.7% and the Government of India introduced additional incentives in this area like as the generation-based incentive (GBI) as well as accelerated depreciation. On the other hand, in 2010, India's solar power industry began significant growth only when the Jawaharlal Nehru National Solar Mission (JNNSM) was announced. After the announcement of JNNSM, grid-connected solar PV capacity increased by 165% in 2011. However, this initiative failed due to financial challenges. So there are two questions have been raised in the context of renewable energy financing. The first question is about 'Cost and terms' which asks 'Are the returns investors are demanding and the conditions they are placing on their investment so onerous as to make the project economically unattractive?' The second question tells about 'Availability' of financing which expresses, 'Is debt or equity just not available? That is, are there enough investors willing to invest or lend to renewable projects in India?' Therefore it is said that potential lower cost international debt can be accessed due to regulatory barriers and accordingly the initiative of renewable energy will face cost risks (Nelson, D., Shrimali, G., Goel, S., Konda, C. and Kumar, 2012).

Renewable energy is regarded as the significant issue of India's energy planning process. To deal with renewable energy resources, the state and central government has set certain rules at both grid connected areas and off-grid connected areas. This sector emphasizes in key aspects like technical and institutional capacity, planning and budgetary allocations, regulatory issues, transparency and accountability, social and environmental issues. Internationally, India's position is six with respect to renewable energy resources. The annual growth of these resources is 22% for last ten years. Further, the Government of India has a capacity to produce additional 724000 MW at the end of 2022. The National Action Plan on Climate Change (NAPCC) possesses a role to conduct a project which has national level importance (Krithika & Mahajan, 2014).

2.2 Background of India's rural area and rate of development

Government of India's Power ministry, renewable energy ministry and forest ministry play an important role to determine its energy resources and compare these resources to the international standard. There is environmental legislation which is related renewable energy resources. The laws are Energy Conservation Act (2001), Electricity Act (2003). Energy Conservation Act is focused to energy efficiency; standards and labelling; energy conservation building codes; energy conservation fund. According to Electricity Act, there is combined existing factors of legislation which is intended to facilitate growth in power sector; competitive market based and this act includes National Electricity Policy, delicensing of generation and captive generation, public ownership of transmission companies, freedom of distribution licenses, license free generation and distribution in rural areas, establishment of State Electricity Regularity Commissions. The provisions and activities which have influences on power sector are elimination of ceiling on foreign equity participation, establishment of Central Electricity Regulatory Commission,

formulation of an action plan for setting up National Grid. On the other hand, there are state reforms which create impact on the power sector like unbundling State Electricity Boards (SEB) into separate generation, transmission and distribution companies; privatizing the generation; establishment of independent state electricity regulatory commissions; tariff reforms of state governments; improvement of operations of SEBs in terms of better management practices, reduction of transmission and distribution losses, better metering (Meisen & Quéneudec, 2006).

The key objectives of renewable energy ministry are to promote deployment of grid connected renewable power generation projects; to promote renewable energy initiatives to meet the energy needs in urban areas as well as in industrial zones; to opt for research, design and development activities at nationally acclaimed institutions and organizations. The strategic and SMART role of renewable ministry is focused on to develop grid interactive renewable power and decentralized renewable energy. The first factor is associated with solar power, wind power, biomass power and hydro power. The second one is concerned about rural energy supply, rural electrification and rural solar lighting (MINISTRY OF NEW AND RENEWABLE ENERGY, 2011). On the other hand, power ministry has played a significant role in the area of generation, transmission, distribution and application of electricity. The power generation capacity in the urban areas was 1362 MW in 1947 which increased to 17326 MW at the end of March 2011.

3. Objectives of the Study

Renewable energy is capable of providing basic infrastructure of transport and communication in the remotest villages. This will be possible only when rural India will be self-sufficient at local level and large gap between urban and rural areas would be reduced. The main aim of the study is to determine the efficacy and outcomes adoption of Renewable Energy. The main objectives of the study are:

- To examine pattern of post-independence growth in the field of renewable energy and its impact on the socio-economic development of rural India.
- To determine the policies and perceptions adopted within the sector and if they were dependent on presumptions or were because of some causative agents

To fulfill the aim and objectives of research methodology, a research design strategy is adopted. The research design strategy is classified under the titles research method (Exploratory, Explanatory, and Descriptive), research approach (Inductive Vs. Deductive), research strategy (Case study, survey, archival).

Inductive approach focuses at exploring new phenomenon or analyzing existing facts about the research area from a unique individual perspective. A specific inductive approach often studied for research literature is grounded theory, proposed by Glaser and Strauss. Precise repetitive analysis is required to establish a new theory within inductive approach. Novel topics of subjects with little available research are studied under inductive approach. Deductive approach is used to understand the subject in a reverse way, instead of formulating a new theory; an existing hypothesis is understood and analyzed. An aim followed by a set of objectives is designed to test a theory and deduced conclusions based on it (Elo & Kyngäs, 2008).

In the proposed work, the deductive research approach is used. Existing models of renewable energy in the selected areas are studied, and inferences are drawn to analyze the model. It is suitable to the chosen research work as the qualitative data from NGO's is made available to analyze these models with efficacy. Based on findings, a theoretical model is proposed.

4. Analysis

1.1.1 Community people's energy resource for cooking

Data Presentation:

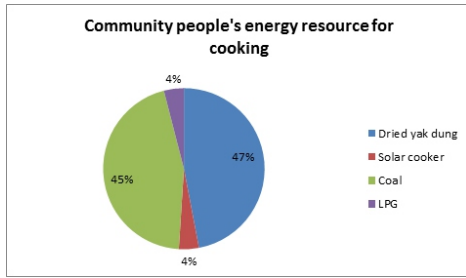


Figure 5.14: Community people's energy resource for cooking

Data Analysis:

The above figure shows cooking energy resources which range from dried yak dung to LPG. It was found from this figure that most of the respondents are intended to use dried yak dung as alternative resources which is indicated by 47% of the respondents whereas only 4% of the respondents have solar cooker. On the other hand, coal was used by the respondents who can afford it and it is represented by 45% of the respondents. Lastly, it was seen that similarly solar cooker, LPG was used by 4% of the respondents. So the economic condition of the respondents can be understood as most of their family occupation is agriculture. Therefore the use of solar cooker or LPG is significantly less than dried yak dung and coal.

1.1.2 Community people's energy resource for transport

Data Presentation

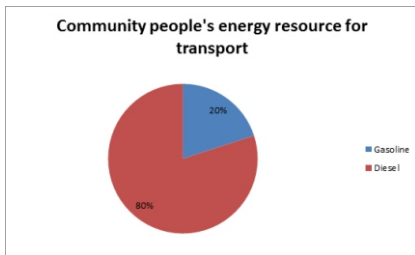


Figure 5.15: Community people's energy resource for transport

Data Analysis:

Transport resources are considered as the most important factor as the whole economy of any city or village is dependent on its transport system. The above figure says that most of the respondents think diesel is used for transportation which is indicated to 80% of the respondents whereas only 20% of the respondents have replied that apart from the usage of diesel, gasoline is also used. The maximum usage of diesel has proved that due to the low cost of diesel, people can afford this resource for their transportation.

1.2 Correlation analysis:

H1: Generation of renewable energy resources impacts consumers in terms of reduction in poverty.

H1A: Generation of renewable energy resources does not create impact on consumers in terms of reduction in poverty.

It can be seen from 5.10 table that the Karl Pearson's coefficient of correlation between generation of renewable energy resources and poverty. The correlation of factors of poverty is presented in this table. The correlation between generation renewable energy resources and poverty is 'I think poverty has decreased after implementing solar water pumps at our village due to the reduction of electric bill' is 0.966 at p=0.000; 'I have seen the local people who are temporarily engaged in these types of project, they are happy for the source of income' is 0.970 at p=0.000 and 'According to me these energy resources are helpful in our agricultural work, so we have achieved food security for next three

months' is 0.953 at p=0.000. Thus, the correlation analysis results suggest that there is high correlation between generation of renewable energy resources and poverty.

Correlations		
		Do poverty has an impact on renewable energy resources?
Do poverty has an impact on renewable energy resources?	Pearson Correlation	1
	Sig. (2-tailed)	
	N	500
I think poverty has decreased after implementing solar water pumps at our village due to the reduction of electric bill.	Pearson Correlation	.966**
	Sig. (2-tailed)	.000
	N	500
I have seen the local people who are temporarily engaged in these types of project, they are happy for the source of income	Pearson Correlation	.970**
	Sig. (2-tailed)	.000
	N	500
According to me these energy resources are helpful in our agricultural work, so we have achieved food security for next three months.	Pearson Correlation	.953**
	Sig. (2-tailed)	.000
	N	500

Table 5.1: Correlation of Hypothesis 1

Source: Compiled using SPSS 19.0

H2: Generation of renewable energy resources impacts consumers in terms of employment creation.

H2A: Generation of renewable energy resources does not create impact on consumers in terms of employment creation.

5.11 Table presents the test result of Karl Pearson's coefficient of correlation between generation of renewable energy resources and employment creation. The factors of employment creation have been presented in this table with its high correlation. The correlation between generation renewable energy resources and employment creation is 'I think that due to the project, good road facility has been already in our area, so it becomes easier for the youth or the businessman to go to their workplace' is 0.954 at p=0.000; 'I believe it is important to maintain the vitality by creating new jobs related to renewable energy sources' is 0.882 at p=0.000 and 'I feel NGO's initiative for the development of self-help group has engaged our village women at various entrepreneurial activities' is 0.900 at p=0.000. Thus, the correlation analysis results suggest that there is high correlation between generation of renewable energy resources and employment creation.

Correlations		
		Does employment creation have an influence for the implementation of renewable energy resources?
Does employment creation have an influence for the implementation of renewable energy resources?	Pearson Correlation	1
	Sig. (2-tailed)	
	N	500
I think that due to the project, good road facility has been already in our area, so it becomes easier for the youth or the businessman to go to their workplace.	Pearson Correlation	.954**

	Sig. (2-tailed)	.000
	N	500
I believe it is important to maintain the vitality by creating new jobs related to renewable energy sources.	Pearson Correlation	.882**
	Sig. (2-tailed)	.000
	N	500
I feel NGO's initiative for the development of self-help group has engaged our village women at various entrepreneurial activities.	Pearson Correlation	.900**
	Sig. (2-tailed)	.000
	N	500

Table 5.2: Correlation analysis of Hypothesis 2
Source: Compiled using SPSS 19.0

H3: Generation of renewable energy resources impacts consumers in terms of developing education.

H3A: Generation of renewable energy resources does not create impact on consumers in terms of developing education.

To test the above hypothesis, correlation test has been conducted which provides Karl Pearson's coefficient of correlation between generation of renewable energy resources and development of education. The correlation between generation renewable energy resources and development of education is 'I support this effort as the children education becomes easier as the establishment of new school which provides them electricity and food.' is 0.952 at p=0.000; 'Renewable energy provides us study opportunities to everyone by arranging classes in evening, so the adequate information can be accessed.' is 0.959 at p=0.000 and 'The knowledge about gender equality has been come to our world through installing these types of resources' is 0.923 at p=0.000. Thus, the correlation analysis results suggest that there is high correlation between generation of renewable energy resources and development of education.

Correlations		
		Do education has an impact on the implementation of renewable energy resources?
Do education has an impact on the implementation of renewable energy resources?	Pearson Correlation	1
	Sig. (2-tailed)	
	N	500
I support this effort as the children education becomes easier as the establishment of new school which provides them electricity and food.	Pearson Correlation	.952**
	Sig. (2-tailed)	.000
	N	500
Renewable energy provides us study opportunities to everyone by arranging classes in evening, so the adequate information can be accessed.	Pearson Correlation	.959**
	Sig. (2-tailed)	.000
	N	500
The knowledge about gender equality has been come to our world through installing these types of resources.	Pearson Correlation	.923**
	Sig. (2-tailed)	.000
	N	500

Table 5.3: Correlation analysis of Hypothesis 3
Source: Compiled using SPSS 19.0

H4: Generation of renewable energy resources impacts consumers in terms of good social life.

H4A: Generation of renewable energy resources does not create impact on consumers in terms of good social life.

Hypothesis 4 has been tested through correlation analysis which delivers Karl Pearson's coefficient of correlation between generation of renewable energy resources and good social life. The correlation between generation renewable energy resources and good social life is 'Due to wind energy, transport facilities have facilitated our life' is 0.953 at p=0.000; 'I am benefitted due to the efforts of NGOs' is 0.942 at p=0.000 and 'Government initiatives have been implemented to each block, so now I am able to experience the mobile communication in our area' is 0.904 at p=0.000; 'I am benefitted due to the efforts of the local bodies' is 0.948 at p=.000 and 'My social life is smooth now for lighting, cooking, especially for electricity' is 0.932 at p=0.000. Thus, the correlation analysis results suggest that there is high correlation between generation of renewable energy resources and good social life.

1.3 Conclusions

In this section, the findings of the study have been concluded with respect to research aim. The findings of primary and secondary research are presented to the conclusions.

This study is aimed to conduct the research on investigating the impact of renewable energy in the overall development of the rural people. Further, the key initiatives, barriers and challenges have been presented through qualitative data.

The secondary research has revealed that India is capable to produce renewable energy resources as the annual growth of these resources is 22% for last ten years. Further, the Government of India has a capacity to produce additional 724000 MW at the end of 2022. The National Action Plan on Climate Change (NAPCC) possesses a role to conduct a project which has national level importance (Krithika & Mahajan, 2014). Further it is also included that rural is understood as an area having the population density of 400 per square kilometers, minimum of around 75% of male working population that includes allied and agricultural activities and villages having the clear surveyed boundaries that has no board of municipal (Ottinger, 2013). Rural India has also contribution in the GDP through the services s like agriculture, construction, self-employment, etc. According to the National Sample Survey, the expenditure in rural areas accounts for 55% of the entire national monthly expenditure (Kothari, Singal, & Ranjan, 2011). According to the sustainability study it was found that India has double the consumption of food, petroleum items, electricity as well as other commodities. So the need of sustainable energy as well as alternative energy was felt in India which could lead towards all round development (Thiam, 2011). Additionally, the inefficiency of public enterprises has been discussed and the objectives of public and private sectors are different with respect to generating electricity. The private sector aims towards generating profits, where else public sector seeks to obtain the benefits of economy, but at the same time try to obtain the social benefits with the primary objectives for ensuring about the public welfare. On the other hand, various government policies have been implemented in this regard and they are Tariff Policy 2006 and Electricity Act 2003 (Naseem, 2010).

In the secondary research, the interface of renewable energy and poverty have been projected which illustrates that due to the lack of energy the children spend more time in collection of fuel, participating in agricultural jobs, and fetch the water. As a result there is low enrolment in schools. But the modern energy availability offers those children an opportunity to increase the daily time duration for course learning in night hours (Moni, M. and Misra, 2009). But the research gap is identified in this study that in the secondary research the impact of renewable energy has been found in poverty and education, but not in other factors like employment, social life.

In order to supplement the research gap, the primary research has been conducted which has satisfied the research aim. According to the conceptual framework, poverty, employment opportunity, education, social life and socio economic influences have an impact for the generation of renewable energy resources. On

other hand, through qualitative data it was found also there is lack of renewable energy initiatives in India and this data has been gathered through the opinions of NGOs. Lastly, the government support is available as the government is eager to implement their policies having various barriers in their initiatives but they get the help from local bodies.

1.4 Recommendation

Based on the findings of the study, some recommendations may be proposed which can help the consumers as well as the NGOs in terms of the influence of renewable energy resources. The recommendations are presented below.

1. Better Representation of NGOs: It has been observed that people are unable to trust NGOs and are unwilling to adopt Renewable Technologies. There, it is recommended that NGOs need to include representatives of the local bodies, so it will be easier for the NGOs to enter the locality, convince the people for the usage of renewable energy resources.

2. Adoption of Better Technologies: The current technologies are expensive and have low efficiency, therefore it is recommended that better technologies are adopted which are more energy efficient.

3. More Government Initiatives: Government needs to invest in more initiatives which are focused on renewable energy resources.

REFERENCES

1. 70% Indians live in rural areas: Census | Business Standard News. (2011).
2. Ahn, S. and Graczyk, D. (2012). Understanding Energy Challenges in India.
3. Amarendra. (1998). Poverty, Rural Development and Public Policy (p. 233). Deep & Deep Publications.
4. ANNUAL REPORT 2013-14. (2014).
5. Bahugunu, S. (2010). Sustainable Development in India: Perspectives.
6. Bangladesh power dev board (2011) An Overview of Power Sector of Bangladesh .Available at <http://www.usea.org/sites/default/files/event-file/493/overviewofbpd.pdf>
7. Battaglia, M. P. (2011). Nonprobability Sampling. Encyclopadia of Survey Research Methods.2008, (1), 523–526. doi:10.4135/9781412961288.n274
8. Bhattacharyya, S. C. (2006). Energy access problem of the poor in India: Is rural electrification a remedy? Energy Policy, 34, 3387–3397.
9. Biswas, W. K. (2012). Bangladesh ' S Energy Sector : The Past , Present , And Future Of Renewable Energy. School of History and Philosophy of Science.
10. Block, E. (2011). Renewable energy in the developing world: case studies - Renewable Energy Focus.
11. By, P., Commission, P. U., & Lanka, S. (2011). Achievements of Renewable Energy Targets in Sri Lanka.
12. Byrnes, L., Brown, C., Foster, J., & Wagner, L. D. (2013). Australian renewable energy policy: Barriers and challenges. Renewable Energy, 60, 711–721. <http://doi.org/10.1016/j.renene.2013.06.024>
13. Chatterjee, S. (2007). The developmental challenge in rural India - The Hindu.