

# Rural Development through Solar Energy

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**Abstract:** This paper presents a study on rural development through solar energy.

**Keywords:** solar energy

## 1. Introduction

Traditionally, rural electrification was not considered as one of basic human needs like water and food. Many recent studies provide information how rural electrification can help in the upgradation of rural society in various ways. In this paper an attempt is made to assess the functionality of the solar PV system provided to households and social impact of the program on the beneficiaries in villages in the states of India.

## 2. Objective of the study

Objective of the study is to know about the impact of solar energy on life of rural Indians.

## 3. Methodology

The paper is based on secondary information collection.

## 4. Study

A study by World Bank for 11 countries states that rural electrification results in great benefits such as improvements of health facilities, better health from cleaner air as household reduce use of polluting fuels for cooking, lighting and heating, improved knowledge through increase access to television and better nutrition from increased knowledge and storage facilities through refrigerator. According to Global Network on Energy for Sustainable Development (GNESD, 2007) without sufficient supplies of affordable energy, it is impossible to improve health and education as well as reduction of poverty. About 1.6 billion of world populations do not have any access to electricity. About 80 per cent of these people live in rural areas of developing countries of South Asia, Central America and South America. In 2001, the 9th session of the Commission on Sustainable Development (CSD-9) gave special attention to energy. It concludes that "Energy is the central in achieving the goal of sustainable development". Due to lack of electricity, kerosene as well as candles is used for lighting in rural areas. A study by Kaplin, showed that burning of candle for a few hours in a closed room results in such lead concentrations which are responsible to cause fetal damage or to harm the mental development of children. Lead poisoning can lead to behavioral changes and damages in internal organs, especially kidneys.

Children in rural areas spend significant portion of their time in households and other activities in day time. They do not have electric-light to study at night. A few hours of electricity to study at night students can result in major improvements in their performance. Women in rural areas spend 2-6 hours every day for cooking with fire wood due to lack of electricity. Therefore, rural electrification should be considered as basic human necessity to improve socio-economic conditions, in rural areas. We can choose Kenya as an example of the social significance of rural electrification with solar energy. In Kenya, in the early 1980s about 4 per cent of rural households only were connected with electrical grid. But now, solar electricity has emerged as a better source of rural electrification in Kenya. The significance of solar electrification in Kenya, therefore, plays an important role in supporting rural-urban connections for Kenya's rural middle class. Electric light from solar system does not play a major role in supporting direct income-generation activities in rural Kenya. As per the distribution of ownership of solar systems, nearly all of these productivity gains are captured by rural-middle-class families.

Solar photo-voltaic (PV) plays a quite important role in supporting the use of electric light for key social activities such as evening time studying by children. Solar electricity in Kenya is widely used for households' needs such as television, radio and cellular telephone charging that helps improve communication. It shows that application of PV light for rural electrification helps in increasing rural income as well as the living standards of the rural poor.

As one more Example, the basic applied forms of solar PV in rural Bangladesh are solar home lighting systems installed in households and local market/bazaar (haat). Seven solar modules of 50 WP each, divided into two groups, had been installed in two different locations of the market. The accompanying battery banks and controllers with each group were placed close to two respective solar panels. Some more similar systems were subsequently installed, serving business activities such as grocery shops, restaurants, barber shops, tea houses and doctors' clinics. The success of solar PV micro utilities can be attributed to several factors. These factors include the acceptability of a daily tariff structure and the rate of five taka, with proper marketing that explains the solar-energy-based system's capabilities, benefits, and constraints in comparison to other available options to users. Benefits of the system accrue because of the use of local institutions. An agreement, signed with the Bazaar Management Committee,

holds the terms and conditions of the service, maintenance procedure, payment, and financial details of the users. The training of a technician for maintenance of the system is viewed favorably by users.

One study shows the impact of renewable energy in changing the socio-economic status of rural women. To improve the position of women in the society is very tough without increasing their income-level. Poverty alleviation may be realized by the introduction of renewable energy system in a sustainable way. The most important point is that income generation is possible. This may happen in many ways. These activities may lead to the establishment of small- and medium sized enterprises. An example can be taken of seeds from oil bearing plants. The seeds can be sold in the market. Women can also go for processing and can make side products like soap. There is a linkage between energy and Millennium Development Goals (MDGs) which is well established and agreed upon by the international community. The UN Millennium Project, too, states that a pre-requisite for meeting the MDGs is to reduce the share of the global population that does not have access to basic levels of electricity, as well as the population dependent on traditional solid fuel for cooking. This Energy vision expects improved access to energy for about 1.5 billion people.

Some other studies have specially searched for the role of energy in achieving these goals, even though energy is not a specific MDG. These studies have focused on looking at the energy needs of the poor and what role energy plays in achieving the MDG.

A study by George et al. finds that rural electrification has affected, even family planning practice, in rural Nigeria. Two different communities of Bonny and Kula were chosen to study due to the similarity in their population, terrain and climate. Fishing is the major source of income of the people in both these areas. On a part time basis small scale farming activity is carried out in both places. Neither processing nor manufacturing activity happens in the two areas. Bonny has regular-electricity facility whereas Kula community does not have electricity at all. The level of electricity consumption of a country is one of the indicators to measure socio-economic development. Per capita electricity consumption in India is at the lowest level in the world. In India near 30 per cent population, is living without access to electricity. The Ministry of New and Renewable Energy (MNRE) of Government of India, is working to implement the Remote Village Electrification Program (RVEP) in all the states.

The household's survey was carried out by NCAER, to collect information from about 10,000 households from 371 villages spread over 41 districts in Assam, Meghalaya, Jharkhand, Odessa, Madhya Pradesh, and Chhattisgarh and other states. The survey was carried out at village level and the other at beneficiary household level to assess the functionality of the systems, the pattern of installation of the system and the impact of the program. The solar home lighting system had

been provided through solar power plant and through solar photovoltaic individual home lighting system. In Meghalaya and Chhattisgarh, the solar light had been provided through solar power plant. In Jharkhand, Assam, Odessa, and Madhya Pradesh solar photovoltaic individual home lighting system had been provided.

Proper functionality of the system is determined by considering many factors such as module capacity, module installation, fixing of luminaries inside the house, fixing of cable, etc. If the module and luminaries are installed properly and cable is fixed from charge controller to module is also proper, one CFL will provide light up to 10 hours during a day in normal weather conditions. The major advantage of solar home lighting system is that energy can be stored in battery for two to three days. In the present study, an assessment has also been carried out to check the duration of light received by the beneficiaries during different seasons as given in the following table-

During winter the functionality of luminaries moderates to 2 to 14 per cent reported and provides light less than three hours in Jharkhand. About 53 per cent of system in Madhya Pradesh reported receives light between 3-4 hours per day in winters, whereas only 20 per cent reported receiving light between 3-4 hours in Assam and Meghalaya. Except in Madhya Pradesh, where majority of beneficiaries reported receiving light for more than four hours per day, in winter season. The performance of the systems goes better in winter and summer due to adequate sun-bask.

It is a fact that the system seems to be very satisfactory in summer as 75 to 91 per cent of beneficiaries reported receiving light for more than four hours in Assam and Jharkhand. It means that system performs better during summer than during winter and rainy seasons.

One other aspect of this system also exists. In some states, as about 52 per cent got the system in 2004, reported getting light for more than five hours as compared to 86 percent, who got the system in 2007, reported getting light for more than five hours in Jharkhand. The performance of the systems is more encouraging in Odessa. About 76 per cent (who got the system in 2007) reported getting light for more than five hours as compared to 81 per cent (who got the system in 2009) reported getting light for more than 5 hours (Fig. 3). Similarly, in Meghalaya 28.5 per cent (who got the system in 2003) reported getting light between 4-5 hours as compared to 100 per cent (who got the system during 2006) reported getting light between 4-5 hours. Hence the performance of the system reduces over the time.

### 5. Use of kerosene has decrease

The survey highlights also that the monthly expenditure on other resources for lighting has reduced substantially after Solar Home Lighting System has been introduced in all the sample states. The beneficiary households have continued to use kerosene still then but for other purposes than lighting the room

after the installation of solar PV systems in the households. The expenditure on kerosene for lighting has reduced by more than half in Meghalaya, Assam and Jharkhand. Multiple activities are possible now for households such as cooking, teaching children and studying, recreation and other household activities if electricity is available in the evening. We also asked them to assign the highest rank to the activity for which maximum time was spent when the light was available at home. About 58 per cent in Jharkhand ranked 1 on teaching children and studying whereas 60 and 45 per cent did the same in Assam and Meghalaya, respectively. This finding is further supported as 64, 69 and 53 per cent beneficiaries reported that there is significant improvement in children's education in Jharkhand, Assam and Meghalaya. Similarly, 28, 52 and 34 per cent of beneficiaries reported that there was significant improvement in children's education in Odessa, Madhya Pradesh, and Chhattisgarh, respectively. About 52, 55, 37, 42, 78 and 48 per cent have reported a little improvement in living standards after introducing of solar lighting system in Jharkhand, Assam, Meghalaya, Odessa, Madhya Pradesh, and Chhattisgarh, respectively. The well recognized factor is the convenience in household work due to installation of solar PV system. The level of satisfaction is better as 49, 60, 75, 48, 39 and 35 per cent have reported 'significant improvement' in daily household work in Jharkhand, Assam, Meghalaya, Odessa, Madhya Pradesh and Chhattisgarh, respectively.

Some of the families said that their kerosene consumption has decreased by 60 to 70 per cent after installation of the solar home lighting system. A few participants said that poor households in their village have totally stopped buying kerosene.

#### A. Income Generation Activities

Solar home system carries many external benefits. It may help in creation of new sources of income for the households. However, the survey finds that only two to three per cent beneficiaries reported that new sources of income generation activities were possible after getting solar light system. As a consequence, those household's income has gone up by 5 per cent monthly in Jharkhand. It can be expanded for other households' also. Even then, the increase in income after installation of solar light is not significant in other states.

### 6. Womens' view

As women are the key persons, engaged in household activities. We tried to get views of women also. Women said that they do households activities in the evening, such as grinding of rice, weaving cloth, etc. in the availability of light. During day time they go to earn their wages. Indirect income earning activities are also possible due to availability of light. The women are highly satisfied with the system, because it makes it easier for them to cook at night and finish their household's tasks comfortably and they can have some time savings. Before installation of the solar streetlights, wild

animals would frequently enter the village and hunt cattle and would many times attack human. But After the installation of streetlights, these mishappenings are reduced in the village. People move around freely even after the sunset also. One woman in Morigaon, district of Assam said, 'I can stay at home alone after the sunset now. Earlier I had to call someone from the neighbor-hood to stay with me because of the fear of the tiger, when my husband was out of the home. The crime was happening at night. Snake and other insect-bites incidents were common in the village, but now situations have improved.

Participants in Chhattisgarh said that education level has also increased in children. Children would study up to primary level only before getting the solar light. But after getting solar light children are studying in the middle level. This implies that drop-out rate has decreased.

Participants said that the school teacher and forest guard were not staying in the village due to lack of electricity. But now the school teacher and forest guard both are staying in the village.

Participants in village Dheba, Kashdol, and Diahampara in Chhattisgarh told to us that after solar light introduction, caretaking of old and sick people went easier. Social activities like gathering, debate, and discussions also take place in the evening. Some participants reported that they could look after their domestic animals better in the evening due to availability of electric light. They also use solar home lights for ceremonies and other social gatherings. A few of the participants in Chhattisgarh said TV was a dream for the villagers, but now they can enjoy TV, albeit a little bit.

Availability of electric light promotes activities which help in improving the household's income, such as making bidi and plates of leaves, rope and weaving. So electric light is useful in so many ways for these areas.

### 7. Findings

The study shows that use of solar energy affects the life of rural Indians in a positive manner. It provides ease of life with availability of electricity. Even farmers are using solar energy for irrigation of agricultural lands. Especially for women it is very helpful. It helps them in food making activities, getting some rest. Solar energy supports rural life to an extent.

### 8. Conclusion

This study shows that solar home-lighting system in the remote areas can influence the life of people significantly for the improvement. Quite sufficient reduction in expenditure on kerosene has been reported in the households of all income groups due to solar home-lighting system, which finally improves savings.

This scheme is very helpful for women and children. Women find it easy to complete household activities especially in the evening, whereas children get enough light to study in the evening and early morning. Crime rate has also declined due to availability of light in these areas. People are very happy with the functionality of solar system. The solar home lighting

system has affected also significantly the numbers of school going children. This system affects the savings level of the persons of remote area, which finally improves their economic condition and happiness.

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