

## GE01

# Impact of Utilization of Solar PV Technology among Marginalized Poor People in Rural Area of Bangladesh

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**Abstract-** Bangladesh is facing serious energy crisis. This paper investigates on how marginalized poor people in rural area of Bangladesh are benefited by utilization of solar PV technology and also focuses on the collaboration of various governmental and nongovernmental organizations to promote this technology. In Bangladesh, Solar energy utilization has been started since 1980. About 45 governmental and nongovernmental organizations are involved in 20 solar projects are being implemented in different rural areas of Bangladesh. The utilization of PV technology in rural area is increasing the income as well as the living standard of the rural poor through rural development, increase business opportunities and increases job scope. It is also observed that women empowerment is progressing and education rate is increasing in rural area. It is revealed that this technology is making a substantial effect in the telecommunication sector in the off grid areas. This technology brings IT to the rural people by establishing computer education, with this education; students improve the quality of their own lives as well as the community. By using this technology instead of dangerous smoke and soot from kerosene lamps, this has reduced their health risk and lessened health related costs.

### INTRODUCTION

In Bangladesh, around 85% of people lack accesses to electricity. About 80% of the people in Bangladesh live in villages and most of them are under poverty line. In this respect, solar PV technology stands out to be one of the prospective sources to combat this adverse situation. Bangladesh is in a very favorable position in respect of the utilization of solar energy. Annual amount of radiation varies from 1840 to 1575 kwh/m<sup>2</sup> which is 50-100% higher than in Europe [1]. Several governmental, private and nongovernmental organizations (NGOs) are working to install solar PV technology in rural Bangladesh to meet basic energy needs. The application of PV technology in rural area is indirectly increasing the income as well as the living standard of the rural poor people.

To assess the situation of solar PV technology and its impact among marginalized poor people in rural area of Bangladesh and also find out the collaboration of various governmental and nongovernmental organizations to promote this technology.

### METHODOLOGY

It is a desk research which has involved the collection of previous research reports, newspapers and journal content also collection, collation and synthesis of existing project reports of governmental and nongovernmental organizations interventions relating to solar PV technology in Bangladesh.

### SOLAR ENERGY POTENTIAL IN BANGLADESH

Bangladesh is situated between 20.30 - 26.38 degrees north latitude and 88.04 - 92.44 degrees east which is an ideal location for solar energy utilization. Daily average solar radiation varies between 4 to 6.5 kWh per square meter. Maximum amount of radiation is available on the month of March-April and minimum on December-January. Annual amount of radiation varies from 1840 to 1575 kwh/m<sup>2</sup> which is 50-100% higher than in Europe. Taking an average solar radiation of 1900 kwh per square meter, total annual solar radiation in Bangladesh is equivalent to 1010 X 10<sup>18</sup> J. present total yearly consumption of energy is about 700 X 10<sup>18</sup> J. this shows even if 0.07% of the incident radiation can be utilized, total requirement of energy in the country can be met. At present energy utilization in Bangladesh is about 0.15 watt/sq. meter land area, whereas the availability is above 208 watt/sq. meter. This shows the enormity of the potentiality of this source in this country. [2]

### COLLABORATION BETWEEN GOVERNMENTAL & NONGOVERMENTAL ORGANIZATION IN IMPLEMENTATION OF SOLAR ENERGY

Solar energy utilization was first introduced in Bangladesh after 1980s. Now near about twenty solar projects are running successfully all over the country. Different governmental and nongovernmental organizations such as Rural electrification Board (REB), Atomic Energy Commission (AEC), Local Government Engineering Department (LGED), and Grameen Shakti (GS) have installed (are in the process of installation of) a number of solar PV systems in different parts of the country. REB has undertaken a pilot project for supply of solar electricity in some islands of one main river (Meghna) in Narshingdi district. Under this project, PV systems have been installed at one rural health clinic for running fans, lights and refrigerators. Same systems are being set up in another clinic. LGED has so far installed PV systems in 5 cyclone shelters, one at Cox's Bazar, four at Patuakhali. Solar Home system (SHS) is the only type of renewable energy technology that has huge success in Bangladesh. This success has been possible because of the direct implementation of solar systems in rural households by NGOs. The Government recently encourages this system realizing the incentives of using this technology. Not only Government organization, there are 2 semi government organizations, 20 non government organizations, 3 private organizations and 15 educational institutions are working for promotion of this technology in rural area. [3] Recently Local government engineering department has taken about 16 projects to promote this technology under the Sustainable Rural Energy (SRE) programme. Under these

all projects, the solar PV technology install capacity is about 35.6 Kwp. [4]

Table 1: Progress with SHS's installation up to 26 October 2009 [4]

Partner Organization	No. of SHSs Installed
Grameen Shakti	269,010
BRAC Foundation	53,103
RSF	45,864
Srizony Bangladesh	11,933
UBOMUS	8,447
BRIDGE	6,210
COAST Trust	3,483
Integrated Development Foundation	4,305
Centre for Mass Education and Science	3,237
Shubashati	2,743
Hilful Fuzul Samaj Kallyan Sangstha	7,155
TMSS	2,240
PDBF	2,305
PMUK	770
Other	388
<b>Total</b>	<b>421,193</b>

Table 2: Division wise installation of SHSs [4]

Division	Number of SHSs Installed
Barisal	64,734
Chittagong	86,195
Dhaka	99,655
Khulna	58,107
Rajshahi	59,280
Sylhet	53,222
<b>Total</b>	<b>421,193</b>

#### SYNTHESIZED RESULTS AND DISCUSSIONS

An overall improvement in the socio-economic lifestyle of the rural people of Bangladesh is observed after using the solar PV technology.

#### *Economic development in rural area through Solar PV Microutility*

One of the main economic activities of rural Bangladesh is based on rural markets called Haat. The trading continues until evening. Generally Kerosene lamps called Kupi, Harricane and mantle lamps called Hazzak are the major appliances used to illuminate the Haat shops. All of these alternatives are detrimental to the environment. Now Client shops are connected to solar PV microutility and using lights to illuminate their shops which are safe and cheap. The first solar PV microutility was established in September 1999 in Manikgonj. Feedback from users of a solar PV microutility in Manikgong Bazaar indicated that users were highly satisfied with this technology. One tea stall owner noted his income had increased significantly, while a grocery shop owner observed that more customers had been visiting his shop. A continuous power supply that

provided light for five hours every evening led to an increase in the shops' working hours. [5].

#### *Social development especially Woman & Children*

Solar PV technology energy program in remote, rural & off grid villages had a tremendous impact especially on women and children. Women can now enjoy hassle free lightening and earn extra money by utilizing their time after dusk by sewing or poultry farming. Women are now involved in repair, maintenance and sale of solar accessories. Around 5000 trained rural women as solar technicians and entrepreneurs and in selling of solar accessories about 80% are women. It made decent jobs for women right in their villages. Children now enjoy better facilities for education. This has helped to increase their social awareness and provide a link to the outside world. Mosques, pagoda, churches, health clinics etc are increasingly using solar home systems. [6].

#### *Mobilizing Social Forces*

It is observed that in remote village, the flow of social forces is increased day by day by utilizing this technology. More than 10,500 School Children from rural areas have learned about solar energy technologies and more than 52,000 rural women have learned to take care of the systems installed in their homes. [6].

#### *Time saved and scope of income generation*

Before the introduction of SHS, families spent a lot of time by walking long distances looking for kerosene in order to have a small amount of light provided by dangerous kerosene lamp. Today, all the families with SHS are able to utilize this time in a more positive way. Some examples of this are: Women are now involved in empowerment activities, including fish farming, poultry farming and men are now more involved in income generating activities e.g. fishing, river transportation. [6].

#### *Making Opportunities for Business*

Solar PV systems not only have extended business hours, but also have made new opportunities for business. For example, TV/radio repairing shops are doing increasing business using DC soldering iron powered by SHS. Micro utility modes allows an entrepreneur, the owner of a SHS to sell electricity to other people such as shopkeepers, who cannot afford a SHS by themselves and use the income to pay his own installments. This system allows a group of poor people to share the cost and benefit of a SHS, which they cannot afford individually. When SHS got introduced in the rural areas, it turned out to be an opportunity for the villagers to open up small businesses like mobile phone charging shops, computer training centers, TV halls and mobile shops. The mobile phone shops have turned out to be a big success story that is yet to be told. In remote areas where electricity has previously been unknown, people are able to charge their mobile phones using the PV module purchased through a soft credit facility provided by Grameen Shakti. The shop owners also charge a small amount of money for receiving and making calls from their telephones. [7].

#### *Business takes advantage of SHS*

People in the rural areas never thought it was possible to open up businesses that stayed open late until after the introduction of solar home *systems*. Today, most of the businesses stay open late in order to catch the late evening shoppers. [7].

#### ***Increase scopes for Job***

Solar energy has produced economic benefits including both self-employments and increased manpower hours. Rural people have realized that, with electricity at their disposal, there is a lot more that can be done to improve their welfare, education, agricultural production, to mention but a few. For example, new jobs have been created where technicians have been trained to provide after-sales services to the customer, and educate the customer on how to operate and maintain the SHSs. Light, Income and Health to 2 million Rural People in 38, 000 Villages through a solar market based programme to become one of the largest & fastest growing rural solar programme in the world. Minimum 20,000 Green Jobs have been created with around 5000 women trained as solar technicians. [7].

#### ***Positive impact on Rural and country Economy***

Use of solar PV technology has produced a positive impact on the rural economy of Bangladesh. Villagers have reduced their dependence on imported oil such as kerosene, diesel etc. This has also saved Bangladesh huge amount of foreign currency spent on importing oil. For example, four 6 W florescent lamps can daily replace 50 ml consumption of kerosene oil. In comparison with long term effect this is more profitable to use solar energy in lieu to conventional fossil fuel. [7].

#### ***Impact on Communication & Entertainment***

Solar system is also creating a substantial effect in the telecommunication sector in the off grid areas. Rural people can charge their mobile phones using the PV technology. Thus, they can communicate to any one easily. Mobile phones are powered by solar chargers in off-grid areas. It has brought a revolution to communication in the rural villages; more than 200,000 Polli phones are in operation in remote areas. Now the people entertained by watching television. Watching television by solar system *develops* the learning about several aspects of life and technology. [8].

#### ***Improvement of Health and Environment***

The internal home and work environment of SHS users has greatly improved by eliminating the dangerous smoke and soot from kerosene lamps that cause respiratory and eye problems. This has reduced their health risk and lessened health related costs. This technology is used in different health care center and it is used for vaccine refrigeration in about 12 health centers in differnt remote areas. It observed that more than 800,000 rural beneficiaries with access to pollution free efficient energy and better indoor environment. Kerosene has been replaced in nearly 88,000 households and has decreased carbon di oxides gas emission in the air. Grammen Shakti installed SHSs have replaced 10.53 kilo ton of kerosene. [9]

#### ***PV technology brings IT to the people***

In the rural areas a lot of students and other potential learners are deprived of the advanced education available to those in the towns. To address this need, Grameen Shakti (GS) is establishing computer education centres in rural and remote places to educate information technology professionals. GS has, to date, established eight-computer education centres in Kutubdia a remote island in the Bay of Bengal, Shakhipur, Kalihati, Patharghata, Dacop, Paikgasa, Cox's Bazar and Moheshkhali. With this education, students may improve the quality of their own lives as well as the community. At the same time they can make great contribution to the economy. [10].

#### CONCLUSION

Bangladesh is a country with enough solar radiation to provide potential for sustaining solar *technology* projects. It is therefore a positive step forward to involving rural communities directly with this technology because this is the only guaranteed way of reducing poverty and increases the quality of life and socio-economic status among the rural people of Bangladesh. As Bangladesh is facing acute energy crisis, so this technology can contribute to overcome the hard situation and can bring sustainable development

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