

# **Application of PV Technology for Rural Electrification and Income Generation: Experience of Grameen Shakti**

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## **Abstract**

*The application of PV technology for electrification and for generating additional income by households is relatively new in rural Bangladesh. This is an emerging sector. Two approaches have been tested: a) selling of electrical power to the users for a monthly bill by keeping the ownership of PV systems with power selling agency, and selling of PV systems. The first approach has been followed by Palli Biddut Samity (PBS) at Narshingdi. More than 600 customers are receiving power from PV systems in this pilot project. The second approach of selling the whole PV system is followed by Grameen Shakti (GS), an specialized renewable energy company and affiliated institution of the Grameen Bank. Grameen Shakti sells PV systems on credit. Customers pay 15% of system price as down payment and the remaining 85% is paid within 3 years in monthly installment along with 12% service charge per annum on balance amount. Up to June 1999, 1033 systems have been installed having 47.7kWp capacity. Some of the customers use PV systems for generating income. For example, customers of GS run radio/TV-repairing shop, power cellular phone, sell power to the neighbors, extended working hour after dusk using PV systems. Although such examples are not numerous but they are on the rise. Major bottlenecks in expansion of PV systems remain to be the very high cost of PV systems, lack of awareness in the rural areas regarding the PV technology and lack of suitable financing schemes for the customers.*

## **Introduction**

The fossil fuels used for generation of electricity are depleting fast. This is more applicable in case of Bangladesh. Although there is a rising hope that Bangladesh might discover sizable quantity of fossil fuel but that may not last long given the projected growth in economic activities. Besides, there is strategic considerations. Should we exhaust all our fossil fuels or keep a part for the future generation and try to develop other alternative sources of energy for a sustainable power generation system?

The issue of sustainable development is gaining steady momentum. The renewable energies being inherently sustainable and environment friendly, are gaining popularity. All developed countries and many developing countries in their energy planning have included renewable energies as important sources of energy for the next century. Many countries are planning to develop renewable energies (PV, wind, hydro) to cover 10 to 40% of their energy needs within couple of decades. However, no such effort is seen in Bangladesh.

Over the years significant technological advances have been achieved in the area of renewable energy technologies, especially in the field of solar photovoltaics and wind energy. For remote rural areas where the conventional grid system may not be viable, these forms of decentralized alternative energy system may be far more adaptable and well suited. This paper briefly describes the experience of rural electrification using PV technology.

## **Rural Electrification in Bangladesh**

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<sup>1</sup> This paper was presented in a international workshop on “ International Workshop on Dissemination of Solar Photovoltaic Energy in Bangladesh” organized by BCAS; and LGED held on 28-30 May, 1999.

The shortage of electrical power in Bangladesh is revealed by the fact that only 15% of the total population is served by the power generation authorities. The chances of reaching the remaining 85% of the people by conventional power may not likely to happen in near future. Up to 1993-94, 17809 villages (20.79%) out of 85,650 villages were connected with grid electricity<sup>1</sup>. Due to shortage of generation, the supply of electricity is not at all reliable. Villagers get a few hours of power supply a day, and worse, it is not available in the evening when power is needed most. That affects education, household activities and income opportunity of villagers.

Renewable energy sources till today could not play a vital role to fill this gap due to lack of proper institutional and financial support. Bangladesh is far behind its neighbors in developing renewable energy sector. It would be of great benefit for the rural population if renewable energy alternatives could be spread.

### **Rural Electrification Using PV Technology**

Rural electrification using PV systems is a recent phenomenon in Bangladesh. Two organizations- Rural Electrification Board (REB) and Grameen Shakti (GS), an affiliated organization of Grameen Bank, are implementing projects to popularize PV systems as an alternative approach to rural electrification. However, they are following two different approaches – REB/PBS is selling power and GS is selling systems to customers.

#### ***PV Program of REB***

REB/*Narsingdi* PBS has implemented a PV project in a remote *char* of *Narsingdi* district. Basically, two different types of systems have been given to the rural households: (i) battery charging facility by central charging stations-households received batteries from PBS which are charged from the charging stations for a fee; and (ii) standalone PV systems have been installed at the homes of the customers. Customers pay a monthly fee for the service depending on the capacity of the system. Presently, 638 customers are receiving power from the REB project. The project has been financed by French Government grant and has used all imported hardware from France.

The main features of REB project are that the systems are owned by REB/PBS and customers pay price for power. Systems are mainly used for lighting and watching TV. One refrigerator was placed in a health center, which is operated using PV system. The experience of REB project can be summarized as follows<sup>2</sup>: (a) Customers prefer stand-alone system mainly due to higher energy availability from the systems and for convenience, batteries need not to be brought to the charging station; (b) customers prefer relatively larger system (46 Wp and above); (c) charging station is not a preferred by customers. Customers do not like to frequently charge batteries from charging stations. It is very inconvenient to bring batteries from far-flung areas. Many batteries have been damaged due to over -discharge.

Grameen Shakti

Grameen Shakti, a 'not for profit' company and a member of Grameen Family of organizations, has been implementing PV program for rural applications for the last 3 years. The main activity under its PV program is installation of Solar Home System (SHS) in *Mymensing, Tangail, Comilla, Khulna, Sathkhira, Bagerhat, Rangpur and Banderban* districts.

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<sup>1</sup> Bangladesh Bureau of Statistics, Ministry of Planning, Government of Bangladesh

<sup>2</sup> Based on the discussion with the customers and project authorities

Grameen Shakti (GS) follows the so called 'hard approach' in implementing the PV program- it sells PV systems in rural areas. GS also installs and maintains the systems. However, to make the system more easily accessible by rural households GS sells PV systems on credit. The present credit system is as follows:

- (a) customers pay 15% as down payment, and
- (b) the remaining 85% is paid in monthly installments within 3 years period.

Up to June 1999, GS has installed 1033 systems with 47.7 kWp installed capacity. Grameen Shakti has installed system in the range of 13W to 215 Wp for different applications like lighting, entertainment (TV), operating computer and cellular phone, heating soldering iron for repairing radio, TV etc. However, the applications are overwhelmingly for household purposes - lighting and entertainment. Businesses and institutions are also trying PV systems to extend their working hours at the evening.

The major experiences of Grameen Shakti is rural electrification using PV systems are as follows: (a) there is no damage of battery, (b) customers are generally happy with technical performance of the systems, (c) some customers are using PV system for income generation, (d) customers usually show interest of PV systems, but the news of REB grid power brings their interest to zero; (e) the main hindrance behind slow expansion of the PV program is the very high cost of the systems.

#### **PV System for Income Generation**

PV systems have also become sources of additional income for rural families. For example, some customers are extending working hours (shops, restaurants, and sawmills), in another case PV system has been used to heat soldering iron in radio/TV repairing shops. In some cases the PV system owners sell power for monthly bills to the shop owners - these are examples of microutility companies. Although it would have been great if the system price could be paid from the income of the system. But the number of such applications of PV systems are small compared to household applications for improving the quality of life. Two case studies related to income generation applying PV systems are cited below:

#### **Case 1: Business with Solar Home System**

Mr. Yunus Miah is a buyer of the SHS marketed by GS at Akhaura under Brahmanbaria district. His wife, who is a member of Grameen Bank and three sons, live with him. He has a tea stall and a rickshaw garage. Besides these, he has several shops, which he rented in the market. He bought a 50 Wp system designed for 4 lights and a TV point from GS at the cost of Taka 23,000. He has paid Taka 6000 as down payment and the rest of the amount will be paid in 24 installments. In each installment, he is required to pay Taka 765 as monthly installment. He took additional two lights instead of TV point. Six lights have been connected to six shops- 3 are grocery shops, 2 are tailoring shop and 1 is tea stall. By renting these lights, he earns Tk. 600 (Tk. 100 from each light) per month. Not only Mr. Yunus is capable of earning extra income but also the shopkeepers are getting benefit of electric light without purchasing the whole system.

#### **Case 2: Cellular Phone Charging by Solar PV**

Mr. Shah Alam created a new dimension in application of PV technology. He has taken a cellular phone connection to his shop at Nabinagar by which he provides telephone service to the customer in a rural areas. Mr. Shah Alam uses the solar system to charge the cellular phone. The

villagers have got a tremendous communication network with all over the world by the phone service operated by solar system. The owner is earning substantial amount of money out of the cellular phone business.

There are other examples of income generating activities using PV systems, such as:

- ◆ PV systems for heating soldering iron for repairing radio, TV etc;
- ◆ Carpenters extend working hours after the sunset using solar system;
- ◆ Selling power to the shop owners.
- ◆ Institutions in the remote areas have improved their productivity by operating solar powered computer.

### **Obstacles of Expansion of PV Technology in Rural Areas**

The major obstacles of rapid expansion of PV systems are as follows:

- (a) The main hindrance is the high cost of system due to high price of the PV module in international market and imposition of government taxes. This year government has removed VAT for solar modules. But devaluation of taka has canceled out the benefit of removal of VAT. The pricing policy of PV module manufacturers makes the system price very high for the rural buyers;
- (b) The lack of awareness about the PV technology requires long time, effort and money for familiarizing the PV technology to the rural areas. Private sector companies and NGOs may find it very difficult to cover the initial cost of dissemination of the technology;
- (c) An alternative to reach large number of rural households could be development of an easy financing system so that the buyers can pay the system price over a longer period of time (for example, 5 to 7 years). The implementing agency automatically requires soft fund to finance the customers, but source of soft finance is so far non-existent.

### **Conclusions and Recommendations**

#### **Conclusions**

The experience of application of PV systems for rural electrification is still limited Bangladesh. But the programs of REB and Grameen Shakti show that there is potential for PV programs that should be seriously pursued. The 50 Wp or similar system is favored by customers. The performance of the systems seems to be satisfactory. But the major hindrances are lack of awareness in the rural areas, very high cost of systems, lack of adequate fund at reasonable cost to the PV systems providers.

#### **Recommendations**

The above discussion leads to the following broad recommendations :

- (a) PV system marketing organizations should develop more flexible and easy financing schemes for the system buyers;

- (b) Government should give financial incentives to private and non-governmental organizations to come forward with innovative PV programs for rural areas;
- (c) A resource pool - Renewable Energy Fund - may be created to mobilize resources for this sector so that private and non-government sector may receive fund at a reasonable cost for expansion of renewable energy programs.