Energy's Role in the Rural Income Generation:

The Grameen Strategy

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Background:

Electricity is considered to be one of the essential inputs for improved quality of life. As a matter of fact, the per capita consumption of electricity is taken as a development indicator of a country or a community. Growths of population and industries have resulted in greater demand for energy worldwide. In Bangladesh per capita annual fuel consumption is only 56 litres of oil, which is one of the lowest in the world. Most of this energy derived from fossil fuel (coal, gas, oil and nuclear) which will soon be depleted. With the predominantly agro-based population of Bangladesh, bio-fuel is mostly used for cooking in the rural sector. On the other hand the lighting needs are met with use of kerosene. Expenditure of lighting is minimized by short evening hours and limited night activities. At the current time 85% of the total people, mostly in rural areas of Bangladesh are without access to electricity from centralized grid. Electrification by solar photovoltaics has emerged as a viable technical option for meeting lighting and other small energy needs of the millions of people living in remote areas of Bangladesh. In this context the need for developing renewable sources of energy was taken on a greater sense of urgency. Over the years significant technological advances have been made in the area of renewable energies, especially in the field of solar photovoltaics (PV), wind energy and bio-gas technology. In addition, for remote rural areas where there exits no infrastructure for conventional energy supply, these forms of decentralized alternative energy system will be far more adaptable and well suited. In addition, it can bring multiple positive results in terms of women's welfare, children's education, employment and income generation. Renewable energy can also bring considerable improvement in rural life through income generation and thus alleviating poverty.

2.0 Introduction to Grameen Shakti

The obstacle of non-electrification prevents Grameen Bank members as well as rural people from earning to their full potential. By having electricity many micro-enterprises can become more lucrative through:

- extending working hours,
- extending selling & shopping hours in the rural areas,
- increasing income from women-led micro-enterprises include basket making, electronics repair, carpentry workshops, tailoring, stores, fish net weaving, and many other activities,
- growing the local technical retailers include local expertise in selling, maintaining, and repairing,

- helping to become productive households,
- extension of housing plan,
- facilitates children's education, women's welfare, recreational activities, income generation of the rural households,
- Extending education, health benefits to end the cycle of poverty.

In the above background a company named **"Grameen Shakti" (GS)** came into existence in June 1996 to translate the ideals of Grameen Bank into reality so far as renewable energy is concerned. The Grameen Shakti aims at:

- Popularizing and delivering renewable energy to the rural households.
- Marketing solar, biogas and wind energy on commercial basis, focusing on rural areas, particularly the clientele of Grameen Bank.
- Providing services that alleviate poverty and protect environment through applied research and development of renewable energy based technologies.
- Undertaking a project to progressively manufacture and market efficient and affordable household based photovoltaic systems.
- Implementing projects to generate electricity from wind in the coastal belts and offshore islands; operate mini and micro hydro-plants in the hilly areas.
- Developing and implementing special credit, savings and investment programs for generation, storage, and utilization of renewable energy for benefit of the rural people.
- Testing the new and appropriate technologies to provide more cost effective energy services at affordable price to the non-electrified areas.
- Providing capital, technology and management services to energy enterprises, including individuals, communities, businesses, non-government organizations (NGOs), private voluntary organizations (PVOs) which promote, produce and finance enterprises based on renewable energy sources.

Programs of GS

Grameen Shakti is a specialised and leading organisation in renewable energy sector in Bangladesh. It is currently implementing projects in renewable technologies: PV Program, Wind Energy Program, and Biomass Program. Besides, training of rural people as well as dissemination of these technologies among the common people is the core activity of each program. In addition, Grameen Shakti works with other entrepreneurs in the private sector.

PV program of Shakti:

Grameen Shakti has installed 430 Solar Home Systems up to August 1998 with installed capacity of 18.174 KWp. It has a plan to install 5000 systems within next 3 years. For this purpose Shakti will open 8 more branch offices (total of 20) in rural Bangladesh. It also plans to open some special branches through which Shakti will research on marketing policy. This network allows Shakti to quickly disseminate and commercialize any improvement in the technology. Since the

systems are expensive for the rural people Grameen Shakti has introduced a soft financing process.

Credit Policy of GS:

A PV system buyer pays 25% of the system cost as down payment and the remaining 75% can be paid within 2 years time in equal monthly installments with 8% service charge on the outstanding amount. But Grameen Bank members can get financing from the Bank where the payments are made in weekly installments instead of monthly installments.

But there remains a group, which can not respond to this financing system. Therefore, Grameen Shakti has developed small systems (one lamp system & two-lamp system) in order to reach the technology within the capability of the lowest income group.

Besides, GS has bridged this technology to some income generating activities, so that the Grameen Bank members can easily adopt the system without exceeding the economic capability.

PV system is also directed to build up some micro-entrepreneurs. The idea of micro-entrepreneur is such that one will buy the system and sell the power from it to the nearby consumers.

The sales of SHS up to August 1998 are given below:

Table: System sold by Grameen Shakti

Area	System sold upto December'97			System sold during Jan-August' 98			System sold upto August 1998		
	No. of Customers	No. of Panels	Watts	No. of Customers	No. of Panels	Watts	No. of Customers	No. of Panels	Watts
Tangail	64	95	2602	39	45	2042	103	140	4644
Mymenshingh	60	92	2980	94	99	4970	154	191	7950
Comilla	18	20	1085	13	13	675	31	33	1760
Shatkhira	0	0	0	30	30	1825	30	30	1825
Khulna	0	0	0	9	9	500	9	9	500
Dhaka	2	9	435	18	18	1060	20	27	1495
Total	**144**	**216**	**7102**	**203**	**214**	**11072**	**347**	**430**	**18174**

Wind Energy Program:

Grameen Shakti has installed two wind turbines in coastal areas. It will install four (4) hybrid power (Wind, PV and diesel engine) stations in October 1998. Grameen Shakti is pioneer in wind energy sector in Bangladesh. It is expected that coastal population will be benefited from this project and it will be a basis for utilisation of wind energy at commercial scale. This wind energy project will be carried out on micro-enterprise zone basis.

Micro-enterprise zone concept: We decided to electrify one main building where micro-entrepreneurs could come and use electricity for their businesses, We expect this center becomes a commercial one, which we call a micro-enterprise zone. The Grameen Bank has many cyclone shelters along the coast, which turned out to be the perfect places to house the micro-enterprise zone. These buildings are two or three storied concrete buildings that often house a Grameen

Bank Branch office. Thus they are frequented by the Grameen micro-entrepreneurs, and enjoy the presence of trustworthy staff. The targeted options of this micro-enterprise are battery charging station, workshops, rice husker, ice making etc.

Bio-mass program:

Grameen Shakti has constructed 30 brick bio-digesters to produce cooking fuel (biogas) and organic fertilizer. Shakti is planning to conduct research to promote bio-digester as an avenue to increase family income in rural areas.

Training Program:

GS gives training to the technician in order to create employment for the local people. It has several dimensions: (a) improving the technical and managerial skills of the professionals of GS for effective implementation of the programs of GS, (ii) transferring and developing skilled technician-cum retailer in the rural areas who will be able to provide after sale services to SHS buyers, provide the accessories and retail SHS as well; (iii) educating the rural people in renewable energy and popularizing the use of renewable energy.

Research and Development Program:

The research programs have three distinct areas: (i) exploring ways to develop appropriate technologies and their uses, (ii) developing ways to popularize and making the renewable energy systems that will be easily accessible to large number of households and institutions, (iii) innovating financial services for the customers to facilitate rapid expansion of use of renewable energies, (v) developing and fabricating the solar accessories (charge controller, lamps, dc to dc converters etc.) locally in order to reduce the total system cost.

Income Generating Activities through Photovoltaics:

Grameen Shakti encourages entrepreneurs to apply PV systems for generation of income. Few examples of application of PV systems for income generation are cited below:

- One customer of Grameen Shakti is using PV system for heating soldering iron for repairing radio, TV etc.
- One carpenter extended his working hours after the sunset using solar system by enabling him earn more than before.
- One saw mill owner has extended his working hours as well by installing solar system.
- Another buyer has installed a system in the rural market and he is selling power to the shop owners who buy power to light their shops. It is an example of micro utility company.
- By operating solar powered computer, some institutions in the remote area have improved their working ability.

There are other opportunities yet to be tested. Some examples are, operating sewing machine, pumping for irrigation, battery charging stations to charge batteries for household use, charging cellular phones in rural areas (Grameen Bank members provide telephone services to villagers),

operating drill machines (for the carpenters), operating blending machines to make juice in market places etc. However, rural entrepreneurs may come up with other innovative ideas.

Few case studies of photovoltaic applications are being cited here.

Case –1

Mr. Hanif is a saw mill owner. The mill is located in the rural area named Dhalapara and is operated by diesel. The villagers bring their timbers to the sawmill for sizing. Before using the solar system the mill owner failed to deliver the timbers in right time. But by working at night with the help of solar light, the working capacity of the mill has increased and the villagers are getting their timbers delivered at right time, which has increased the number of customers.

Type of use	: For lighting a diesel operated saw mill.
Project location	: Village-Baromedor, District-Tangail
System description	: One 17W solar module Two 7W fluorescent lamp
Total system cost	: US$ 270
Mode of payment	: 25% down payment 75% by instalment with 8% service charge per annum Repayment period is 2 years
Daily hours of use	: 4 hours
Impact of solar system	: **Direct impact** - Extending working hour (4 hours/day) - 20 US$ extra income per day (100 cft/day @0.20US$/cft) - Better quality of work - Better working environment **Indirect impact** - Increasing income of the workers - Increasing employment opportunity - Increasing social status

Case-2

Mr. Manik, husband of a Grameen Bank member operates a repairing shop of the electronic/electrical appliances. The main obstacle of his business before using the solar system was, heating up the soldering iron. Now by the help of solar system he is using the DC soldering iron operated by solar power to test the appliances and using solar light for his shop that enables him to work even at night.

Type of use	: Using solar power for repairing the electronic appliances (e.g. TV, radio, cassette, emergency light etc.) in an electronic repairing shop.

Project location	: Village-Dhalapara, District-Tangail
System description	: One 34W solar module
	Two 7W fluorescent lamp
	One outlet for powering TV, radio etc.
	One DC soldering iron
Total system cost	: US$ 354
Mode of payment	: 25% down payment
	75% by instalment with 8% service charge per annum
	Repayment period is 2 years
Daily hours of use	: 4 hours/day (for lamps) & 6 hours (for iron)
Impact of solar system	: **Direct impact**
	- Increasing income by efficient repairing of appliances by electrical iron.
	- Extending working hour at night time
	- 25 US$ more income per day than before
	- Increased efficiency of work
	- Better working environment
	: **Indirect impact**
	- Increasing income of the workers
	- The villagers feel easy to use entertaining appliances.
	-Increasing the standard of living of the villagers.

Case-3

Mr. Umor has a grocery shop at of kornel bazar. He has bought a solar system with six lamps. He uses one lamp for his shop and has rented other five lamps to the nearby shops. He collects the rent @2.5 US$ per lamp per month from those shops. Not only Mr. Umor getting more money with the help of this system but also the other users are selling more at the night. This is an example of micro-utility model.

Type of use	: Earning by selling solar power to the shopkeepers.
Project location	: Village-Kormel Bazar, District-Brahmanbaria
System description	: One 50W solar module
	Six 7W fluorescent lamp
Total system cost	: US$ 520
Mode of payment	: 25% down payment
	75% by instalment with 8% service charge per annum

Repayment period is 2 years

Daily hours of use : 4 hours

Impact of solar system : **Direct impact**

- Running a business by providing solar lights to the shopkeepers on rental basis.
- 12.50 US$ income per month (@2.5US$ /lamp per month)
- Explored an additional way of income
- Earning more from his shop by attracting more customers at night by brighter light.

: **Indirect impact**

- The income of the other shopkeepers has also increased due to the use of solar light.
- The customers are feeling easy to market at night.
- Making easy the living status of the villagers.
- Increasing social status

Case-4

Use of solar system has given Mr. Shah Alam a new dimension of business. He has taken a cellular phone connection to his shop by which he provides telephone service to the customer in a rural area named Nabinagar where no other telephone facility exists. The villagers have got a tremendous communication network with all over the world by the phone service operated by solar system.

Type of use : Operating cellular phone powered by solar system.

Project location : Village-Nabinagar, District-Brahmanbaria

System description : One 50W solar module
Two 6W fluorescent lamp
One socket for charging cellular phones battery.

Total system cost : US$ 450

Mode of payment : 25% down payment
75% by instalment with 8% service charge per annum
Repayment period is 2 years

Daily hours of use : 4 hours (for lamp) & 8 hours (for phone)

Impact of solar system : **Direct impact**

- Running a business by private telephone service.
- 30.00 US$ income per day [30 calls/day @1.00US$(average)/Call]
- Better quality of work
- Better working environment

: **Indirect impact**

- Established a good network between the rural and the urban areas.
- Villagers are happy to getting the way to communicate with their relatives living abroad.
- Increasing the business position of the locality by the communication system.

Case-5

Mr. Uttam kumar is operating a barbershop in the market place of Sagordighi. In past it was not possible for him to work after evening. Now he has rented a lamp from a solar system owner (from a micro-utility model) to light up his shop at he night. Therefore he is able to work at night and thus earning more.

Type of use : For lighting up a barbershop.

Project location : Village-Sagordighi, District-Tangail

System description : One 8W solar lamp on rental basis.

Rent per month : US$ 2.5

Daily hours of use : 4 hours

Impact of solar system : **Direct impact**

- Increase of working hour (4 hours/day)
- 5.00 US$ extra income per day
- Better quality of work at night
- Better working environment
- Attracting more customers

: **Indirect impact**

- Increasing income of the workers
- Providing better service to the villagers
- Busy villagers are happy to make their hair cut at the off time (i.e. at night).

Impact of Photovoltaic on Women:

Electrification by solar systems have directed the housewives to some income generating activities (e.g basket making at night, net weaving, tailoring etc). The solar light has eliminated the health hazard kerosene lamp thus providing a better environment. Women need not to bother for lighting up their houses at every night. It is also helping in improvement of the children's education. The bright lights have ensured the women's security. The areas where the wind turbines will be installed will be developed as a micro-enterprize zone. The targeted options of this micro - enterprize are electric sewing machine, ice-making, rice-husking etc, where women will be encouraged to participate.

Conclusion:

Solar photovoltaic systems are most suitable for electrification of isolated remote areas in developing countries like Bangladesh. But people living in such backward area can hardly meet the high cost of solar PV system due the poverty. By introducing a soft loan procedure Grameen Shakti has already sold 430 numbers of Solar Home Systems.

From the examples, it is seen that solar electricity has helped a lot the rural people who are involved in business and other activities. Having access to electricity they can work at night and can earn extra money. Electricity has improved children's education, women's security as well as the social status of the villagers. Grameen Shakti's effort helps rural people to achieve better quality of life. GS cannot change the whole scenario but at least it can demonstrate a way that creates an opportunity and hope for the rural people to alleviate their poverty and improve the life style.