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REPORT FOR ACTIVITY 5

RURAL ELECTRIFICATION PLANNING FRAMEWORKS IN BANGLADESH

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1. Introduction

1.1 Background

Rural electrification is one of the keys to rural development and is gaining high priority in developing countries to meet the economic and social development goals. Extension of electricity grid to supply remote rural communities could be more expensive as compared to the urban areas due to lower load densities, lower capacity utilization rates, and often higher energy losses. So, alternative approaches are necessary in order to meet rural electricity needs in the least expensive way.

Among the CLV (Cambodia, Lao PDR and Vietnam) countries, Cambodia and Lao PDR, are in the initial phase of the rural electrification process with the electricity coverage of 15% and 40% respectively as of year 2003. In the same year, Vietnam has achieved the electricity coverage of 83.5% and has planned to expand the coverage to 90% of the total population by 2005. In Cambodia, the government has planned to increase the coverage to 70% by 2030, while the government of Lao PDR has set the target to achieve 90% electricity coverage by 2020.

The structure of electricity supply in CLV countries are also different, leading to differences in use of available recourses for electricity generation. The structure of electricity supply in Cambodia consists of 24 small isolated power systems and around 600 small, private rural electricity enterprises (REEs). The electricity generation is mainly based on diesel (89% in 2003) and consequently the price of electricity is one of highest in the region (16 USc/kWh in Phnom Penh, 30 to 90 USc/kWh in area served by REE). The power system in Lao PDR consists of four isolated gird system served by Electricity du Laos (EdL). The generation plants are mainly based on hydro power, accounting to 97% of total generation in 2003. In Vietnam, power system consists of an integrated grid managed by Electricity of Vietnam (EVN), a state owned utility under Ministry of Industry.

In order to scale up rural electrification in CLV countries, it may be necessary to consider and adopt decentralized systems. In this regard, some of the Bangladesh experience in implementing rural electrification policies and programs, both grid extension and off grid system can be a lesson to the Cambodia, Lao PDR and Vietnam.

1.2 Objective

The main objective of this study is to examine the current situation in the power sector and rural electrification, and present the rural electrification development in Bangladesh, with emphasis on the decentralized rural electrification planning and policy options, and the opportunities of the private sector to participate in rural electrification development. The lessons Bangladesh could be interesting for the design of planning framework in rural electrification in the ASEAN countries.

1.3 Scope and Limitations

The study is limited to the case of Bangladesh and is based on secondary information available in published literature as well as the information available in the official website of the relevant agencies.

1.4 Organization of Report

The first part presents background information along with the objective and scope of study. The information regarding the power sector, its organization and the institutional agencies is dealt in second chapter. The third chapter presents a brief review of national energy policy. In the fourth chapter, the current status of rural electrification, rural electrification approach, role of different organizations, financing and delivery mechanism are presented. The fifth chapter presents an analysis regarding Bangladesh initiative in implementing rural electrification program that can provide lessons to ASEAN countries specifically, Cambodia, Lao PDR and Vietnam. Finally, the conclusions and recommendations for the design and implementation of a framework to rural electrification in ASEAN countries in presented in the sixth chapter.

2. Overview of Power sector

2.1 Country Background

Bangladesh is located in South Asia and has borders to India in the north, west and north-east, Myanmar to the east and the Bay of Bengal to the south. The area of the country is 148,393 sq. km. Bangladesh is the eighth largest country in the world with the total population of 138.1 million [1]. Around 86% of the population live in the rural areas and agriculture is the main economic activity in the country. The per capita GDI in 2003 was US$400 [1]. Bangladesh has a per capita energy consumption of 154.8 kg oil equivalent, which is one of the lowest in Asia [1]. Only about 32% of its households have access to electricity and per capita electricity consumption is only 144 kWh [2]. Figure 1 presents a map of Bangladesh.

Figure 1: Map of Bangladesh

2.2 Power Sector at a Glance

By 2003, Bangladesh's power sector provided access to electricity to only 32% of the total population [2]. Installed power generation capacity was 4,680 MW (88MW in 1960), of which approximately 85% was gas based electricity generation, 5% by hydro power and 10% by liquid fuel (diesel and furnace oil) [2]. The maximum power demand in 2003 was 3,712.5 MW [2]. The power generation mix presented in Figure 2 shows that Bangladesh power generation is mainly dependent on natural gas, which had a share of 85% in 2003.

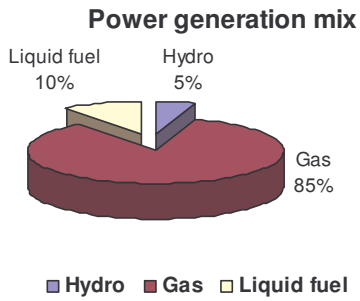

Figure 2: Power generation mix, 2003 [2].

The power sector in Bangladesh is organized under the Ministry of Energy and Mineral Resources. The ministry manages the Bangladesh Power Development Board (BPDP), the Dhaka Electricity Supply Authority (DESA), and the Rural Electrification Board (RED). BPDP is by law responsible for generation and transmission of power while distribution is the responsibility of different government corporations. Private power generation is allowed. As part of the sector reform (1998) new public entities such as the Power Grid Company of Bangladesh Ltd. (PGCB), and the Dhaka Electric Supply Co. Ltd. (DESCO) as well as private sector IPPs have been constituted. The electricity sector is organized as shown in figure 3.

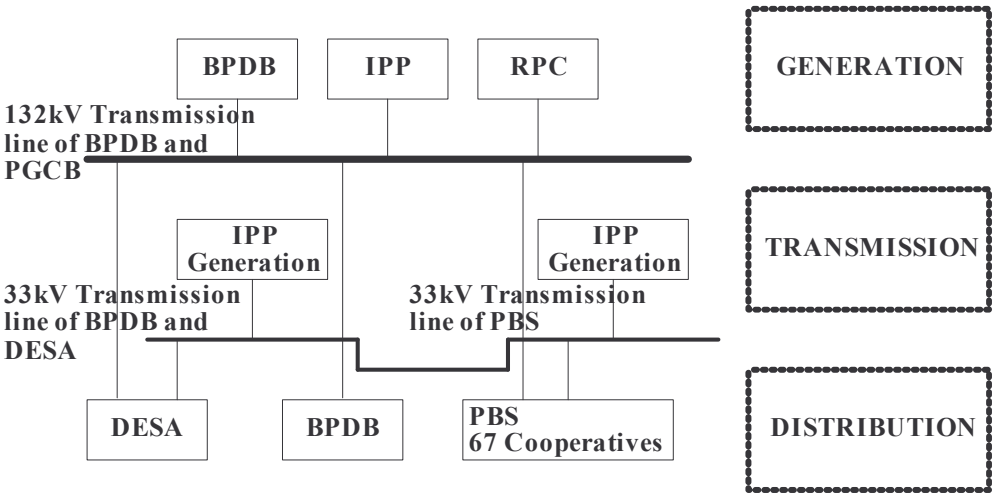

Figure 3: Organization of electricity sector [3].

2.3 Power Sector Reforms

Power sector reforms started in 1977 through the creation of Rural Electrification Board (REB) to augment rural electrification program. Until 1977, Bangladesh Power Development Board (BPDB) was the sole agency responsible for generation, transmission and distribution of electricity throughout the country. No further reform took place until 1991, when the Dhaka Electric Supply Authority (DESA) was created to take over the electricity distribution system of the capital city Dhaka from BPDB as part of unbundling process. In 1992, industrial policy was amended to open the power sector for private investment. In 1993, a high power inter-ministerial committee was constituted to recommend further reform measures. The committee recommended

unbundling of the sector according to functional lines and establishment of an independent regulatory commission. Power cell, an institution under the Power Division, was created in 1995 to design, facilitate and drive reform measures. In the same year, the National Energy Policy was prepared and it was adopted in 1996. Again to introduce competition, induct foreign private capital and increase power supply in the country, the Private Sector Power Generation Policy was developed and adopted in 1996. As a part of unbundling process, Power Grid Company of Bangladesh (PGCB) was created in 1996 to take over transmission business from BPDB. And to take over a part of distribution business of Dhaka city from DESA, Dhaka Electricity Supply Company (DESCO) was created in 1996. Some of the distribution areas under BPDB has been converted into strategic business unit as a part of the reform process.

2.4 Institutional Agencies

At present the entities responsible for different functions of the electricity sector in Bangladesh are:

Bangladesh Power Development Board (BPDB)

BPDB is responsible for generation, transmission and distribution of electricity. Its distribution jurisdiction covers mainly urban areas except Metropolitan City of Dhaka. There are a number of Independent Power Producers (IPPs) who generate and sell power to BPDB.

Power Grid Company of Bangladesh (PGCB)

PGCB, established under the Company's Act, 1994 is wholly owned by BPDB. It is presently responsible for operation of a small part of the grid network and implementation of 100 km new 230 kV transmission line including related substation. In future, the total transmission system will be under PGCB.

Dhaka Electric Supply Authority (DESA)

DESA is responsible for distribution of electricity in greater Dhaka area. It purchases power from BPDB at 132 kV.

Dhaka Electric Supply Company (DESCO)

DESCO, established under Company's Act of 1994 is responsible for distribution of electricity in Mirpur area of the Metropolitan City of Dhaka in Greater Dhaka. DESCO purchases power from DESA.

Rural Electrification Board (REB)

REB is responsible for distribution of electricity in rural areas through a system of cooperatives known as *Palli Biddyut Samities* (PBS). It purchases power from BPDB and DESA at 33 kV.

3. National Energy Policy

The National Energy Policy of the Government of Bangladesh was adopted in 1995 for the overall development of the Energy Sector.

The main objectives of the National Energy Policy are:

- Provide energy for sustainable economic growth,
- Meet the energy needs of the country,
- Ensure sustainable operation of the energy utilities and a rational use of total energy sources.

National Energy Policy (NEP) listed the energy sources, presented energy status, and status of energy consumption by type of available energy sources and consumption strategy. The policy also analyses the supply and demand sides of energy of the country. The recommended energy policy for Non-renewable energy includes assessment of indigenous resources, supply and augmentation of indigenous resources, reduction of imbalance in energy consumption by Urban-Rural and East-West Zones basis, fuel mix, allocation of non-renewable energy sources for power generation, fertilizer production, industry, commercial and domestic purposes by percentage. The NEP has also developed pricing policy as overall policy and specific policy. It also keeps provision for energy audit. The policy recommends system loss reduction, environment impact assessment, energy stocks, investment and lending terms. The NEP also stressed on human resource development side by side. The National Energy Policy also formulated separate Petroleum Policy, Oil Refining Policy and Lubricating Oil Policy.

The NEP also formulated a separate policy for renewable and Rural Energy similar to that of the Non-renewable energy. The most important of them is the power policy. The policy took into consideration issues like demand forecast, long term planning and project implementation, investment and lending term, power supply to the West Zone, power supply to isolated and remote load centers, captive and stand-by generation, system loss reduction, load management and conservation, reliability of supply, system stability, load dispatching and most importantly, private sector participation. The National Power Policy also recommends a separate and clear policy for Rural Electrification. Besides, these action plans, the NEP takes into active consideration the role of environment and recommends steps for protecting the deterioration of environment (Bangladesh Bureau of Statistics, 2000).

4. Rural Electrification in Bangladesh

This section discusses the rural electrification issues in Bangladesh through the key indicators, such as, stakeholders for rural electrification, electrification status, and electrification approaches.

4.1 Rural Electrification Status

Table 1 shows the rural electrification coverage in Bangladesh over the years. In 1976, only about 3% of the total population in Bangladesh had access to electricity,

mainly in urban centers and suburban areas. The vast rural areas, comprising 91.2% of the population in 1974, had practically no access to electricity [4]. By 1982, about 0.2% of the rural households were using electricity, whereas 40.7% of the urban households had access to electricity (Table 1). By 1991, electrification level of the rural households increased to 3.7%. The next 10 years (i.e. 1991 – 2000) saw a marked improvement in the electrification level of the rural households. By 2000, 19% of the rural households and 80% of the urban households had access to electricity. As of 2003, 32% of the Bangladesh population had access to grid electricity.

Table 1: Electrification level (%) in Bangladesh [4]

	1976	1982	1991	2000
Total	3.0	5.1	15.1	31
Rural	-	0.2	3.7	19
Urban	34.1	40.7	73.7	80

Table 2: Number of electrified households in Bangladesh [4]

	1976	1982	1991	2000
Total	411,664	842,482	2,983,414	8,143,623
Rural	No data	25,972	610,330	4,064,197
Urban	411,664	816,510	2,373,083	4,079,429

4.2 Consumer Category and Electricity Tariff

The electricity tariff set by the BPDB in 2003 is summarized in Table 3 [2]. Only the energy charges are shown in Table 3 and applicable demand charges are not shown here.

Table 3: Electricity Tariff of BPDB [2]

Consumer category	Range	Cost per kWh
Domestic Category-A	0-100 KWh 101-400 KWh 401 & above for all units in KWh	Tk. 2.50 Tk. 3.00 Tk. 5.00
Agricultural Pumping Category - B	Flat	Tk. 1.84
Small Industry Category-C	Flat Peak Off peak	Tk. 3.83 Tk. 5.36 Tk. 3.05
Non-Residential Category-D		Tk. 3.20
Commercial Category-E	Flat Peak Off peak	Tk. 5.04 Tk. 7.82 Tk. 3.62
Medium Voltage 11 KV General Category-F	Flat Peak Off Peak	Tk. 3.62 Tk. 6.41 Tk. 2.99
Extra High Voltage (DESA-132KV) Category-G-1		Tk. 2.12
Extra High Voltage 132 KV General Category-G-2	Flat 2300-0600 hrs 0600-1300 hrs	Tk. 2.68 Tk. 1.42 Tk. 2.36

	1300-1700 hrs 1700-2300 hrs	Tk. 1.58 Tk. 5.25
High Voltage 33 KV General Category-H	Flat Peak Off Peak	Tk. 3.41 Tk. 6.14 Tk. 2.89
Rural Electrification Board (33KV) Category-I	i)PDB to REB ii) DESA to REB	Tk. 2.05 Tk. 2.12
Street Lights & Pump Category-J		Tk. 3.68

Note: Tk. (Taka) is the Bangladesh monetary unit (1 US$ = 58.4 Taka in 2003)

Table 3 shows that low consumption households and agriculture consumers are subsidized from commercial and industrial consumers. The REB, that supplies electricity to rural communities via PBS, purchases electricity from BPDB at 2.05 Taka/kWh and from DESA at 2.12 Taka/kWh. Even under the PBS, electricity charges will vary among the different consumer categories.

4.3 Rural Electrification Approaches

Most of the rural electrification projects have to take account the economics, the local energy resources and technology available and the willingness to pay by the rural consumers in the process and successful access to electricity services. The various rural electrification approaches in Bangladesh are listed below:

- Central grid based rural electrification;
- Off-grid decentralized rural electrification.

4.3.1 Central Grid Based Rural Electrification

The central grid based rural electrification model has been the traditional approach to provide electricity to people in Bangladesh. The Rural Electrification Board (REB) has the responsibility for rural electrification through by 67 *Palli Bidyut Samities* (PBS). The REB is working under support from the United States Agency for International Development (USAID) through the National Rural Electric Cooperative International (NRECA), which has played the role of consultant from the concept stage. The program is modeled after the rural electric cooperatives of USA, which electrified rural areas in the USA during the 1930s. The National Rural Electric Cooperative Association (NRECA), under the USAID program, first conducted feasibility studies to establish such a concept in Bangladesh in 1976. Based on these studies, USAID assisted and supported the establishment of the REB. The approach is successful due to the fact that NRECA continues to be a partner in addition to the many other international donors and thus it has come about with a large amount of donor-led financial assistance. The NRECA International has committed to the process of rural electrification project from the inception. Additional, a long lasting partnership between NRECA and stakeholders in the country was build by inquiry of a large donor investment (mainly from USAID). This helped to establish, develop and sustain the program.

The REB's activities in rural electrification are in line with the government's policies for poverty alleviation and employment generation. The program has grown tremendously to now serve 5.39 million rural customers through the 67 rural

cooperatives PBS [5]. The success of the model lies in the fact that rural people are active partners and stakeholders in the projects. With such local level participation, the system requires it be transparent in the crucial areas of management and operations.

Therefore, if the REB selects an area for electrification, the first activity is to establish a partnership with a few key individuals from the area. This partnership will develop into a rural based organization, which will evolve into an operating PBS, while all the time being under the strict guidance of the REB. The system lends itself to be accountable to each other, be it REB or a PBS.

A PBS is formed as a rural electric cooperative in a selected rural area consisting of about 4 to 6 Thanas (sub-districts) by the REB under a set of strict rules and guidelines. The REB finds suitable people from the area to be a part of the voluntary Board of Directors and this establishes the foundation for the link between the community and the REB. The REB then invests in establishing the PBS utility with the necessary transformers; transmission and distribution lines to link up the selected customers. These customers will be the members of the PBS. The customer is treated as the most important stakeholder in the process.

The success of this approach can be judged by the fact that the PBSs operate in a financially sustainable manner. There are low distribution losses (15.6% in FY 2003-2004), no reported thefts of electricity and nearly 100% successes in bill collections [5]. There is also a strict system of 'checks and balances' in the area of procurement. The REB instills strict discipline into the process through comprehensive training in areas of management, rules and regulations. REB also hires the executive management of the PBS and has the power to terminate their employment with the PBS board approval for non-performance. There is also a Performance Target Agreement that is signed every year to improve on the previous year, based on criteria such as increasing revenue, decreasing system losses, increasing number of connections etc.

4.3.2 Off-Grid Decentralized Rural Electrification

About 68% of the total populations in Bangladesh do not have access to electricity. A major portion of this population are located in off-grid areas and will probably not have access to electricity in the foreseeable future due to several constraints, including low consumer density and inaccessibility. So, off-grid energy technologies can play a significant role in the remote locations of Bangladesh. However, the government of Bangladesh has concentrated its resources on achieving rural electrification through grid extension. As a result, there has been little development on off-grid rural electricity supply subsystems despite the limited extent of the current rural grid. Recently, two developments have resulted in the opening up of off-grid rural electricity supply in Bangladesh. The two developments are 1) the emergence of a household solar PV industry with NGO and bilateral donor support and 2) the Bangladesh REB's adoption of a renewable energy policy and implementation strategy for off-grid electricity supply. To date, the developments are confined to household solar PV systems. This is consistent with Bangladesh's rural energy resource base where there is only limited development potential for hydropower and wind power.

Solar Program

The off-grid decentralized rural electrification is increasing due to emergence of household Solar Photo-Voltaic (SPV) industry with NGO and bilateral donor support and the REB's adoption of renewable energy policy and implementation strategy for off-grid electricity supply.

Grameen Shakti (a non profit company) a subsidiary of *Grameen Bank,* has been a leader in building a household SPV industry in Bangladesh by providing financing mechanisms to rural consumers for such systems through its rural banking network consisting of large number of branch banks. As of June 2004, *Grameen Shakti* has installed 23,231 Solar Home Systems with an installation capacity of 1.25 MWp [6].

Bangladesh REB's renewable energy policy has selected household SPV systems as it's preferred option for providing electricity supply to the regions of Bangladesh that will not be reached by the rural grid for at least five-years. The REB program would provide SPV systems on a monthly fee basis with the PBSs retaining ownership of the household SPV systems. The monthly use fee would be set by REB and would be based on a measure of a consumer's ability to pay for a system. A PBS would also be responsible for maintaining the household SPV systems it owns.

World Bank is currently developing a Rural Electrification and Renewable Energy Development Project to support development of rural household SPV systems. Under the project around 50,000 solar home system will be installed during the period of 2003 to 2008.

Wind Program

Wind power development in Bangladesh is still in primate stage. A Hybrid Wind Power systems (Solar, Diesel) is installed by *Grameen Shakti* mainly in coastal locations with total capacity of 10 kWp. Similarly a 10 kWp Wind Solar Hybrid system is installed at St. Martins Island by Local Government Engineering Department (LGED) [6].

Micro-Hydro Program

The development of Micro-hydro is also in initial stage. A 10 kW Micro Hydro Power unit is installed by LGED in Chittagong district [6].

Biomass Program

There has been some development in the biogas sector. The Bangladesh Council of Scientific and Industrial Research (BCSIR) has installed around 17,200 biogas plants (family type and community biogas plant), LGED has installed 1,166 biogas plants (family type and community biogas plant) and Bangladesh Rural Advancement Committee (BRAC) has installed 1,200 biogas plants [6].

4.4 Key Players Involved in Rural Electrification

A large number of organizations are currently involved in the development of rural electrification and renewable energy in Bangladesh. These include government organizations, semi-government organizations, NGOs, research and development organization and the private sector.

Government Organization

The following government organizations and departments are involved in rural electrification process:

Bangladesh Power Development Board (BPDB) – BPDB is responsible to carry out distribution in most of the areas of Bangladesh except Dhaka and its adjoining areas and some rural areas. It is also involved in dissemination of solar home system and centralized solar PV system.

Local Government engineering Department (LGED) – LGED is a vital player in rural infrastructure development including solar energy in Bangladesh. It also executes Renewable Energy Information Network (REIN) to disseminate information regarding renewable energy through its comprehensive web database.

Semi-government Organization

Rural Electrification Board (REB) – REB is responsible for rural electricity supply and for the implementation of rural electrification, especially through the extension of nation grid. REB has created 67 *Pali Bidyut Samities* (PBS) throughout Bangladesh that execute the rural electrification with active participation of the local community. PBS is based on the model of Rural Electric Co-operatives in USA. PBS operates and manages a rural distribution system within its area of jurisdiction and is an autonomous organization registered with REB. The consumers participate in policy making of PBS through elected representative to PBS governing body. PBS uses an area coverage concept for expansion of electricity that generally comprises 5-10 *thanas,* 1,500 – 2,000 sq. km. area, 15,000 – 30,000 consumers and 800 - 1,500 km. distribution lines. For each PBS load forecast is made for next 20 years. The cost of distribution system is given to PBS on a 33 year term loan. To maximize consumer welfare, PBS operate on the financial principle of "No-loss and No-profit" basis. REB model is one of the success story in Bangladesh rural electrification and have been instrumental in attaining high level of operational efficiency. The distribution loss accounts for 15% and the billing collection is nearly 100%. This is a good achievement in comparison to the other south Asian counties. The performance of PBS is monitored by REB through performance target agreement negotiated annually between each PBS and the REB. REB reward PBS that performs well relative to target and penalizes employees of PBS with poor performance. As of June 2004, 67 PBS supplies electricity to around 5.39 million consumers.

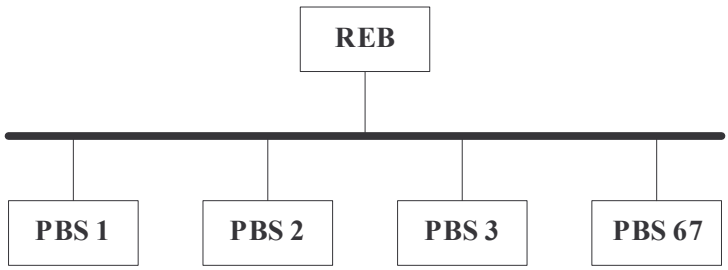

Figure 4: The structure of REB/PES Model

Source: Rural Electrification Board (REB) of Bangladesh, June 2000.

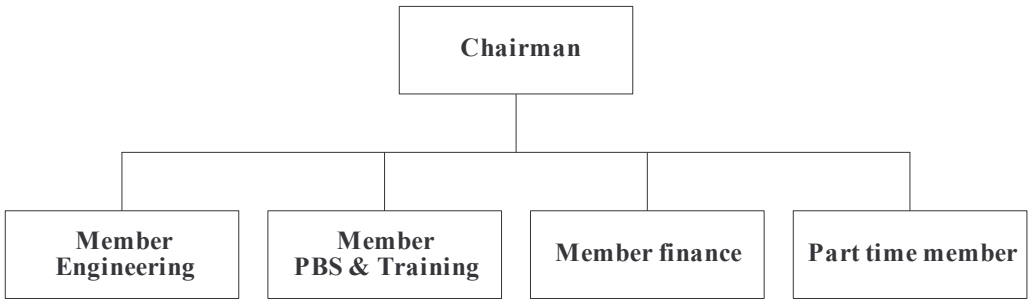

Figure 5: The management team of REB

Source: Rural Electrification Board (REB) of Bangladesh, June 2000.

Bangladesh Council for Scientific and Industrial Research (BCSIR) – BCSIR is involved in research and development in the field of renewable energy technologies and in development of pilot scale dissemination of improved stoves and biogas plant as well as carry out the acceptability on solar energy devices.

Infrastructure Development Company Ltd. (IDCOL) – IDCOL is an organization with a mission to promote economic development in Bangladesh by encouraging private sector investment in infrastructure projects. IDCOL is involved in the Rural Electrification and Renewable Energy Development Project (REREDP), which is intended to help Bangladesh accelerate its electricity access rate by promoting mainly solar home system (SHS) and a few wind, mini-hydro, and biomass renewable energy projects in rural areas where conventional grid electricity is absent and/or is unlikely to reach in near future.

Non-government Organization

Grameen Shakti – *Grameen Shakti* is an NGO that has been involved in the dissemination of solar home system with soft financing schemes. It allows different credit mode to the consumer to purchase solar home system and has deployed around 23,231 solar home systems till April 2004.

Bangladesh Rural Advancement Committee (BRAC) – BRAC is the largest development organization in Bangladesh with the objective of "Alleviation of Poverty

and Empowerment of the Poor". BRAC also launched integrated and multipurpose solar energy program in 1997 and has installed over 9497 solar home systems.

Others NGOs – Other NGOs like SHUBASHATI, Center of Mass Education in Science (CMES), Bangladesh Center for Advanced Studies (BCAS), ANANDO etc. are also involved in the dissemination of solar home system in small scale.

Private Entrepreneurs/Companies

Different private entrepreneurs and companies currently manufacture, provide sales and after sales service of the renewable energy equipments.

Research and Development Organizations

Many universities (eg. BUET, KUET, etc) are also involved in the research and development of renewable energy technology in Bangladesh.

4.5 Financing Mechanism of Renewable Energy Technology

Financing is one of the main barrier for the wide spread deployment of environmentally friendly renewable energy technologies (RET). Currently the major source of external financing is the fund from Global Environment Facility (GEF) and Clean Development Mechanism (CDM) [6].

In 1998, The Government of Bangladesh lifted import duty and Value Added Tax (VAT) from solar photovoltaic and wind turbines. Similarly, solar PV program of different government bodies (BPDB, LGED, REB) are basically subsidy driven.

Biogas Plants

The Government of Bangladesh (GOB) at present gives 7,500 Taka subsidy for a family-size biogas plant which can be used for cooking and lighting, under the Biogas Pilot Plant project [6].

Solar Home System (SHS)

At present different financing mechanisms are available for Solar Home Systems. Mainly they are of following three types [6];

- **The fee-for-service option –** This option is implemented by REB Narsingdi 62 kW Solar Photovoltaic Project and will be replicated in other off-grid areas in the future projects. About 800 Solar Photovoltaic units of five systems ranging from 6 to 92 Wp have been supplied in this project. Consumers pay monthly bills according to the acquired system. All the new SHS projects of REB will follow the fee-for-service scheme in the future.

- **Credit Sell Option –** This option is implemented by *Grameen Shakti,* LGED and BPDB. *Grameen Shakti* offer the four credit modes for those who want to buy the system on credit. In first mode, the customer has to pay 15% of the total price as down payment and remaining 85% are to be repaid within 36

months with 12% service charge. In second mode, the customer has to pay 25% of the total price as down payment and remaining 75% of the cost are to be repaid within 24 moths with 8% service charge. In third mode, the customer has to pay 15% of the total price as down payment and the remaining 85% of the cost are to be repaid by 36 account payee cheques in advance. In the fourth mode, 4% discount is allowed on listed price in case of cash purchase.

LGED has implemented a Credit Sell Scheme for solar home systems with subsidy under the Sustainable Rural Energy (SRE) program. BPDB is currently implementing subsidized credit sell of different solar PV applications in the Chittagong Hill Tracts Solar Electrification Project.

- **Cash sell –** This option is implemented by *Grameen Shakti* and different dealers, where the solar home systems are provided on cash payment.

Small Wind Turbines

Different types of small wind turbines are sold by several private dealers in the country.

5. Rural Electrification Best Practices and Lessons for CLV countries

Although, the pace of rural electrification in Bangladesh is not remarkable, however, the model of electrifying rural population via *palli Bidyut samities* (PBS), has been successful. With the local participation in PBS, they have been able to achieve a low loss figure, no reported theft and an excellent billing collection. Similarly, with over 50,000 solar home system installations, Bangladesh is doing quite well in the distributed renewable energy sector also. In this regard, some of the best practices in implementing rural electrification program in Bangladesh can be good lessons for the CLV countries.

Local Participation

Local participation in planning and operation of rural electrification and renewable energy development is very essential for success and sustainability. The Bangladesh model of rural electrification (mainly by grid extension) through REB via establishment of *Palli Bidyut Samities (PBS)* has been a success story. PBS is a cooperatives managed by local people operating under the principle of no profit and no loss. Its operation is monitored from REB via standard performance target. Within each PBS, the distribution network is designed on the basis of “area coverage rural electrification”. Each PBS covers in general an area of 1,000 to 1,500 sq. km. with 15,000 to 30,000 consumers and includes some 800 to 1,500 km of distribution lines. With this arrangement the PBS has achieved almost 100% billing collection with minimum distribution loss of around 15%. It was possible because of the involvement of the local people in the operation and management of the PBS.

Micro Financing

The up front cost of the solar PV system is relatively high for a typical rural household. As such, financing becomes an integral component of marketing solar PV systems. However, financing is a specialist business and outside the core area of a typical company marketing solar PV systems. There are entities such as *Grameen Shakti* in Bangladesh where there is in-house financing. *Grameen Shakti* provides credit for purchase of solar home system under different credit modes (e.g. 15% down payment and rest on installment over 36 months; 25% down payment and remaining on installment over 24 months; 4% discount on cash purchase). This mechanism allows flexibility to consumers to purchase equipments based on their willingness to pay the upfront cost.

Satisfied existing customers are an important source of new sales as people in surrounding areas have seen the system in operation. In many instances, a household may not have sufficient funds in hand to pay for an entire system, if financing is not available. In these cases, the technician/sales person has to make a judgment on the creditworthiness of the customer and install a system based on this.

Taxes and Subsidies

One of the common barriers for the promotion of renewable energy technology for rural electrification is taxes. Exemption of taxes can lead to wide spread use as in the case of Bangladesh where solar and wind generators are exempted from import duty and value added tax (VAT). The government gives 5000 Taka subsidy for a family-size biogas plant which can be used for cooking and lighting purposes under the Biogas Pilot Plant project. Similarly, solar PV program of different government bodies (BPDB, LGED, REB) are basically subsidy driven.

Such tax exemptions and subsidies could be provided in CLV countries to promote renewable energy technologies.

Institutional arrangements

A typical organization has to have a relatively flat structure with the front line team of technicians and sales people empowered to make crucial decisions in order to make a sale. This requires training as well as a well-defined set of procedures and guidelines in within which to operate.

Sales of a solar PV happen in many different ways:

- At the solar center/shop in the village
- During demonstrations at village markets
- While the technician/sales person travels through the areas visiting existing customers

The company has to establish infrastructure in potential rural areas in order to market, promote, assess requirements, design, sell, install and maintain systems. This center has to also keep in stock parts and items such as bulbs, fuses, controllers, lamp-circuits, and batteries in order to respond to after-sales requirements as quickly as

possible. Micro financing has now become an integral part of a successful solar business. This happens in-house like in the case of *Grameen Shakti* in Bangladesh

Human Resources

Marketing solar PV is a difficult business. The frontline team has to endure much physical hardship to reach customers. Then there is the challenge of selling a relatively new technology, which costs much higher than what people have been paying for energy. On the other hand, one cannot get away from the fact that, the organization has to be profitable to be sustainable. The direction to achieve this success has to come from the top of the organization, often based in an urban center of a country.

Therefore, the challenge is for the top management to define performance in terms of the right outcomes (i.e. sales targets, customer satisfaction levels) and let each team member find their own route to achieve these outcomes. Feedback is an essential part of this process. *Grameen Shakti* does an annual customer service survey to get feedback from customers. There are also random checks on customer satisfaction levels. This is an excellent way to keep track of the performance of the team on achieving the outcomes.

Customer Service

Customer service is the key success factor in developing this market. This is a challenge in the solar PV business given the fact that the customer base is spread out over distances. *Grameen Shakti* takes customer service so seriously that they do an annual independent customer service survey to ensure that accepted standards have been met. There is always room for improvement, so these surveys are used as important feedback towards improving service.

Overall, rural populations are becoming more and more sophisticated. Typically, for the first purchase the customer may not have cared about the design of the lamps fixtures, but after a year, they like an upgrade to more aesthetically pleasing fixtures, at least in the living room areas. Customers also like to move on from a black and white TV to a color TV or to get a fan, which then requires an upgrade in power. These create more opportunities for PV business.

6. Conclusion and recommendation

Even though, the current electricity coverage is limited to 32%, the Bangladesh model of implementing rural electrification by gird extension via *Palli Bidyut Samities* (PBS) has been very efficient and sustainable. The involvement of grass root level in the operation and management of electricity of the locality has lead to the success of this model. This can be a lesson for the CLV countries, especially Cambodia and Lao PDR. Similarly, in decentralised energy sector, Bangladesh has achieved to install more than 50,000 solar home systems by means of suitable intuitional setup, financing mechanism, deliver structure and tax incentives and subsidy. The mechanism of implementing solar home projects in Bangladesh can be lessons for CLV countries to scale up decentralised renewable energy initiatives.

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