Market Report on Renewable Energy Technologies in Bangladesh

By Prokaushali Sangsad Limited
Dhaka, Bangladesh

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1. Introduction

Growth of population and industrialization has resulted in increasing demand for energy worldwide. Most of this energy is derived from fossil fuel (coal, gas, oil), which is available in limited quantities and unable to meet the demand of the future generations. On the other hand, the conversion of fossil fuel into consumable energy like electricity continues to cause irreparable damages to the nature and environment due to Green House Gas emission. This has necessitated increased focus on Renewable Energy Technologies (RET) for all countries of the world. These include solar, biomass, wind, micro-hydro and other technologies as available in each country. In Bangladesh the most abundantly available renewable resources are solar and biomass. There is some possibility of wind and micro hydro based energy development although they are very little in quantity and specific to some locations only.

The most prevalent use of biomass is for cooking and agro processing. About 80 percent of the country's need is met with biomass. Traditional cooking devices with low efficiency are used for the purpose. In recent years the biogas technology is also being developed to meet the increasing need for clean energy.

Solar Photovoltaic (PV) electrification is becoming a prominent part of the rural electrification program in Bangladesh in the recent years. It is anticipated that solar PV will complement the well-established national grid electrification program in the rural sector through public and private sector initiatives.

1.1 Background

The present report is part of an investigation towards determining the investment possibilities of RET in Bangladesh, funded by the Asia-Invest II program of European Commission.
The aim of the project is to inform small and medium (SME) sized companies and NGOs from Bangladesh, who are already active in the renewable energy business, about small and adapted technologies from Europe, and investing co-operation opportunities with small and medium enterprises from EU.

1.2 Objective and Methodology

This report has been compiled with a view to give an initial understanding of the present situation of availability of resources, market for the technologies, capacity in manufacturing and implementation of various technologies and investment opportunities. Most of the market data are secondary, and information has been updated from the published and unpublished data of the individual organizations.

2.1 Renewable Resources Available In Bangladesh

Renewable energy resources are highly site specific. For accurate assessment of renewable resources, availability of micro-climatic data is essential. Some projects are underway for estimating the various parameters of RET assessment. National average data from the meteorological offices are available for wind and solar energy systems. Under the SWERA project, some Institutes and Universities are also logging data related to solar energy and wind energy at different parts of the country. Brief description of different renewable energy resources of Bangladesh are given below.

SOLAR ENERGY:

Bangladesh is situated between 20.300 - 26.380 degrees north latitude and 88.04 - 92.44 degrees east longitude, 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 months of March-April and minimum on December-January. Different R&D Organizations, Institutes and Universities are collecting solar insolation at different parts of Bangladesh. There is significant prospect for applications of solar thermal and photovoltaic systems in the country.

Government sponsored research organizations played pioneering roles in the demonstration and dissemination of photovoltaic systems in Bangladesh. The initial pilot projects were initiated by the Atomic Energy Commission during 1988. Rural Electrification Board of Bangladesh begun their households solar electrification program in 1995 with support from the French Government, which introduced the technology to the public sector. Noteworthy implementation for rural households started during 1996 when Grameen Shakti was founded with a plan of micro-financing SHS with seed funding from GEF. Around the same time few private enterprises and other non-governmental organizations took the initiatives in PV business. The Coastal Electrification and Women's Development Cooperative (CEWDC/UBMUS) with technical assistance from Prokaushali Sangsad Ltd. (PSL) started its solar electrification project with financial supports from ESMAP, ICCO – a Dutch NGO, and the German embassy in Dhaka.

Using the indicators of national market for SHS[1] and its feasibility[2] a large solar electrification program called "Rural Electrification and Renewable Energy Development (RERED) Program" is being implemented since 2002 with financing from World Bank and GEF. Under this program, IDCOL, a Government owned entity already disseminated 50,000 SHSs. Under this program Rural Electrification Board (REB) will install another 16,000 systems within June 2007. Organizations like BPDB has undertaken projects in the Chittagong Hill Tract areas covering 8000 homes, and LGED has also implemented solar programs for electrification of cyclone shelters in the coastal regions. There is a potential of a larger program of 100,000 to be funded by KfW for extending the SHS program of IDCOL.

The role of private sector has remained limited to hardware supply. At present there are a limited number of suppliers carrying stocks of solar PV hardware within the country. However, representatives of international manufacturers of solar modules including British Petroleum (BP), Kyocera, and other suppliers from India, China and other countries are trying to develop a more active presence in the country.

[1] Market Assessment Survey of Solar PV Applications in Bangladesh, by Prokaushali Sangsad Ltd. for The World Bank July 1998

[2] Feasibility Study for a SHS Project Within the Context of Alternative Options for Rural Electrification for The World Bank. March 2000

Individual retailers and installers that sell systems to the end users with after-sale services are becoming prominent. Some NGOs have established themselves successfully, while more NGOs and co-operatives have started their programs to enter in this business recently.

Considering the high upfront cost, the SHSs are still beyond the affordability of most of the rural people of Bangladesh. Very few households can purchase them with cash. Under these circumstances, possibility of payment on installments under the Government's RERED project implemented by IDCOL has proved to be a very strong instrument in making SHS attractive to the rural people. The REB program is designed to provide electrification as pay-for-service, which started in February 2006 is expected to cater to the remote areas and lower income households as well.

BIOMASS:

Biomass is the most significant energy source in Bangladesh which accounts for 65% of the total final energy consumption in Bangladesh. The main sources of biomass fuels are (a) Trees, wood fuels, twigs, leaves, plant residues (b) Agricultural Residues - paddy husk, bran, biogases, jute stick etc. and (c) Livestock -animal dung. A comprehensive study needs to be carried out to assess the biomass potential of the country for modern renewable energy applications like gasifies or biomass based modern fuels. Recently there is much interest in using biomass from animal waste into usable biogas. The GOB has initiated biogas projects for the past decade through the BCSIR and LGED. Several R&D activities from the national laboratories has also been informative. However a noteworthy initiative is the current biogas program of IDCOL being implemented with support from SNV of the Netherlands, with a plan to implement 30,000 biogas plants within 3 years. Other projects include the work of Grameen Shakti and potential support of GTZ in this sector.

Solid Waste

The main cities of Bangladesh are already over burdened with solid wastes from different sources. According to the World Banks study, the rural population generates only 0.15 kg per capita per day, while their urban counterparts generate 0.4 to 0.5 kg per capita per day [World Bank, 1998]. None of the city corporations, responsible for waste management, are able to handle the solid waste properly. Waste-to-energy projects that have been planned earlier did not materialize since the designs did not adequately reflect the properties of the waste, and the necessary infrastructure is not in place. A well designed project could be developed to reduce the overwhelming waste disposal problems of metropolitan cities of the country as well as provide energy as the by product.

WIND ENERGY:

In Bangladesh, some early studies on wind energy prospects were made by Dhaka University [Hussain et. al 1986]. The Bangladesh Meteorological Department has wind speed measuring stations in towns and cities. During 1997 DFID and GTZ have also sponsored studies to assess the wind resource in the country. Some of the data from the reports are given as Annex. Data from earlier measurements and analysis of upper air data by CWET India show that wind energy resource of Bangladesh is not good enough (i.e. below 7 m/s) for grid connected wind parks [GEF 2001]. But, small wind turbines can be installed in the coastal regions of the country.

SWERA Project:

In most of the developing countries, renewable resource information is absent or inadequate. This is one of the major barriers for wide-spread deployment of RETs in these countries. Understanding this obstacle, United Nations Environment Program (UNEP) is implementing a

3-year (June 2001 to July 2004) long "Solar and Wind Energy Resource Assessment (SWERA)" project with GEF fund. SWERA has started with the following countries - China, Bangladesh, Sri Lanka, Nepal, Ghana, Kenya, Cuba, Honduras, El Salvador, Nicaragua, Algeria, Brazil and Guatemala. The overall goal of this project is to promote the integration of wind and solar alternatives in national and regional energy planning and sector restructuring as well as related policymaking. The project will enable informed decision-making and enhance the ability of participating governments to attract increased investor interest in renewable energy. The final report for this project is under preparation by the Dhaka University. It is expected that from the middle of the year 2006, energy planners or private entrepreneurs in Bangladesh will have clear understanding regarding the solar and wind energy potentials at different parts of the country.

MICRO HYDRO:

Bangladesh is a riverine country with three main rivers (1) Ganges (2) Brahmaputra and (3) Jamuna. About 1.4 trillion cubic meter (m^3) of water flows through the country in an average water year. Numerous rivers flow across the country, which are mostly tributaries of these main rivers. Out of these, 57 rivers are transboundary which originate from India and Myanmar. Apart from the south-eastern region, other parts of the country are mostly flat in nature. Major rivers of the country have high flow rate for about 5 to 6 months during monsoon season, which is substantially reduced during winter. More than 90% of Bangladesh's rivers originate outside the country, due to which proper planning of water resource is difficult without neighboring countries' cooperation. However, there is limited potential of small hydro power plants in the hilly regions and existing irrigational canal systems in the country.

GEOTHERMAL:

Geothermal energy is the natural heat of the Earth. It is a renewable source of energy if the exploration process doesn't hamper the ecosystem or emit greenhouse gases. There is a known hot salt water spring, known as Labanakhya, in Bangladesh at 5 kilometer to the north of Sitakunda (40 kilometer from Chittagong). Possibility of extracting energy from this site or any other unknown sites can be investigated by Satellite Remote Sensing or Physical Surveys.

3.1 Market Players of RET in Bangladesh:

3.1.1 Government & Semi Government Organization:

a) **Organization: BCSIR**

Type of Organization: Research Institute.
Business Address: BCSIR, Dr. Kudrat-E-Khudha Road, Dhanmondi, Dhaka-1205, Bangladesh.
Tel: 880-2-861 0072, 966 0173, 861 6829, 862 2908
Fax: 880-2-861 3022, 966 0173
E-mail: bcsir@bangla.net, ret@bdcom.com
Web: www.bcsir.org

Major functions of the Organization:

- Pursuing R & D activities on renewable and non-renewable sources of energy.
- Pilot scale dissemination of improved stoves & biogas plants all over the country through ADP projects of Government of the Peoples of republic of Bangladesh.

- Provide training courses on construction, maintenance and uses of improved stoves technology and biogas technology to technical & non-technical personnel's of GOs & NGOs.
- Conducting feasibility studies on wind, mini-micro hydro energies by ADP project of Government of the Peoples of Republic of Bangladesh.
- Provide technical assistance and consultancy to the entrepreneurs in the field of renewable and non-renewable a sources of energy.
- Create awareness about renewable energy technologies through seminars, symposium, workshops etc.
- Studying the acceptability on solar energy devices viz, solar oven, water heater etc.

Related Renewable Energy Services: Bio Energy, Solar Energy, Micro Hydro, Wind Energy

Level of involvement in Renewable Energy Technology (RET): Research, Implementation and Training.

Experience of RET Installation in Bangladesh: Installation of Biogas Plant, Improve Stoves of Biomass, and Feasibility study on renewable energy technology.

System Present Condition:

Improved stove & Biogas plants are proven technologies. Durability of the technologies depends on proper installations, monitoring, follow-up & technical back-up services.
Site selection for installation of wind turbine, wind pump & solar PV systems has been selected. Installations of these technologies and data collection for feasibility study of micro mini hydro in some hilly areas are in progress.
Annual Budget on RET Installation:
Improved stoves Dissemination project (2nd phase): Taka *402,33,000(1998-2001)*
Biogas pilot plant project: Taka *913,00,000 (1996-2000)*
Feasibility study on R & D on Renewable Energy Technology (Solar, Wind & micro Hydro): Taka158,07,000 (998-2001)

Organization: Local Government Engineering Department
Sustainable Rural Energy (SRE) project Financed by UNDP/MoEF

Type of Organization: Government
Business Address: Project Manager, Sustainable Rural Energy(SRE), Local Government Engineering Department, LGED HQ, GIS Unit, Level-4, Agargaon, Dhaka-1207, Bangladesh.
Tel: +88-02-811 9138, 811 2126
Fax: +88-02-811 6390
E-mail: sreproject@sdnbd.org, sreproject@yahoo.com, zmsajjad@gmail.com
Web addresses:
www.lged-rein.org *(Renewable Energy Information Network)*
www.lged.gov.bd/sre

Major functions of the Organization: Sustainable Rural Energy (SRE) project has been conceived within the overall framework of Sustainable Environment Management Program (SEMP) being implemented by the Ministry of Environment and Forest (MoEF) with financial assistance from the United Nations Development Program (UNDP). The twin objectives of SRE component under SEMP are technology demonstration and technology transfer in the field of renewable energy in Bangladesh. Considering the natural resource base and socio-economic condition, SRE project has considered four potential renewable energy sources in Bangladesh to deal with and these are: solar, biomass, wind and micro-hydro. The activities taken under SRE projects can be grouped into three main categories:

- Demonstration of renewable energy technologies
- Capacity building through training on renewable energy technologies
- Hosting of *Renewable Energy Information Network (REIN)*

Level of involvement in Renewable Energy Technology (RET): Demonstration and Implementation of RET, Capacity building in RET through training.

Experience of RET Installation in Bangladesh: Installation Solar PV System at Cyclone Shelters, Installation of 1142 nos. Biogas Plant throughout the country, Installation of wind pump, promotion, dissemination & demonstration of RET (Solar, Wind, Micro hydro & Biomass) through Sustainable Rural Energy projects.

Organization: RURAL ELECTRIFICATION BOARD (REB)

Type of Organization: Government

Business address: REB Head Office
Nikunja -2, Khilkhet, Dhaka- 1229

Tel. +88-02- 8916424-28/8916413,
Tel:+88-02-891 6913 (Renewable Energy Cell)
Fax +88-02-8916400
E-mail: mbrpbst@citechco.net (Renewable Energy Cell)
E-mail: chiefpp@bdonline.com

Major functions of the Organization:
- To establish electricity generation, transmission & distribution system in the rural areas of Bangladesh.
- To take measures for the effective use of electricity.
- To determine the criteria for rural electrification & associated works.
- To organize the prospective consumers of electricity into formal & informal groups such as Palli Bidyut Samities (PBSs)
- To receive grants & raise loans from the govt. & other bodies.
- To advance fund to any Samity (PBS) or other group.
- To hand-over the completed scheme to any PBS or other group for the operation & management.

Related Renewable Energy Service: Mainly solar energy implemented through the rural cooperatives called Palli Biddut Samities.

Date of involvement in RET development: 1994

Priority wise activity: System Design, Installation Supervision, Operation & Maintenance.
Level of involvement in RET: Planning, Implementation, Monitoring, Training, Research

Organization: BANGLADESH POWER DEVELOPMENT BOARD (BPDB)

Type of Organization: Government Organization

Address: Business Address: Chairman, Bangladesh Power Development Board (BPDB), WAPDA Building, Motijheel C/A, Dhaka-1000, Bangladesh.
Tel: 880-2-955 4820, 955 0808
Fax: 880-2-956 4765
E-mail: chbpdb@bdonline.com, ppbpdb@citechco.net
Web: http://www.bpdb.gov.bd

Major functions of the Organization:
Bangladesh Power Development Board (BPDB), established in 1972, is responsible for planning, construction and operation of power generation and transmission facilities throughout Bangladesh and for distribution in urban areas except Dhaka and its adjoining areas. Total installed capacity of BPDB is 3603 MW (including 302 MW generated by Independent Power Producers).
BPDB generates electricity from both the renewable (hydro) and non-renewable sources (natural gas, furnace oil, diesel etc.). There are some remote places where solar photovoltaic is used for supplying electricity to lighting and communication equipment.
BPDB has plans to harness solar energy, wind energy and mini hydro for power generation.

Related Renewable Energy Services: Micro Hydro Energy, Solar Energy
Level of involvement in Renewable Energy Technology (RET): Implementation, Training & Research.

Experience of RET Installation in Bangladesh: BPDB has plans to implement renewable energy projects of wind, solar and small hydro at remote locations of the country where the electricity grid has not yet reached. It has installed 4 Wind turbines of 250kW capacity on the Muhuri Dam in the eastern part of the country.

e) Organization: INFRASTRUCTURE DEVELOPMENT COMPANY Ltd. (IDCOL)

Type of Organization: Government owned Limited company. It is a multi-donor funded financing institution with a major role in managing finances for the government.

Address:
UTC Building, 16th Floor,
8 Panthapath, Kawran Bazar, Dhaka-1215, Bangladesh
Tel: +88-02-9114385, 8111235, 8117526,9143157
Fax: +88-02-8116663
E-mail: idcol@dhaka.agni.com
Web: www.idcol.org

Role of IDCOL: IDCOL is a non-bank financing organization
- Refinances loans for purchase of SHSs made by the NGOs /MFIs selected as POs and
- Provides technical assistance, loans and GEF grants to POs for development of sub-project (pilot on wind, hydro, and biomass power system).
- Provides GEF grants to lower initial investment cost of SHSs and technical assistance for institutional development of POs.

Major functions of the Organization:

- Electrification through grid extension;
- Rural electrification through off-grid option and chiefly solar home systems (SHSs);
- IDCOL participates in the off-grid part of the REREDP project;
- Arranging training for the organizations engaged in the solar and other programs.

Major Partners & their Role:

- Technical Standard Committee (TSC)- Sets the technical specifications for renewable energy systems;
- Publicity committee (PC)- Review and approve publicity materials designed for raising awareness about renewable energy;

- Participating Organization (PO)- Implements the project: Supplier PO - only supplies and sells SHSs, Lender PO-only lends, Supplier and lender PO - sells SHSs as well as lend;
- Operations Committee (OC) -reviews the operational and implementation aspects of the project.

Implementation Method:

- POs select areas for promotion of SHSs and identify customers,
- Customers put an up-front contribution (down payment)
- (Lender) POs extend loan for balance of the system cost
- POs tie up with suppliers for the supply and installation of SHSs approved by the TSC
- POs submit grant and refinance application supported by SHSs installation certificate and customer acceptance receipt.
- After verification, IDCOL approves grants, and refinances up to 80% of loans made by POs to households

Level of involvement in Renewable Energy Technology (RET): IDCOL provides grants and refinances SHSs through NGOs where 50,000 households have purchased SHSs since the project started in 2002. USD32 million was received from IDA and Global Environment Facility (GEF) for the RERED project. In addition, IDCOL is in the process of having access to EUR 17.8 million from KfW and GTZ for extension of the solar programme. It is also going to receive EUR 14.9 million from SNV of the Netherlands and other donors for implementing a nation wide domestic biogas and manure program.

Experience of RET Installation in Bangladesh: Solar PV System, Solar-Wind Hybrid, PV-Grid, Biogas

3.1.2 PRIVATE & NON-GOVERNMENT ORGANIZATIONS

a) GRAMEEN SHAKTI

Type of organization: Company (Not for Profit)

Business Address: Grameen Shakti, Grameen Bank Bhaban, Mirpur-2, Dhaka-1216, Bangladesh
Tel: +88-02-900 4081, 9004314,
Fax: +88-02-801 3559, 801 1138
E-mail: g_shakti@grameen.net
Web: www.grameen-info.org/grameen/gshakti
www.gshakti.com

Major functions of the Organization: The main objective of Grameen Shakti is to develop and popularize renewable energy resources. It presently implements three programs: Solar Energy Program, Wind Energy Program and Bio gas program. Grameen Shakti sells, installs and maintains photovoltaic systems in various parts of the country. The systems are also maintained by Grameen Shakti. Besides, training to customers and other interested persons and R&D in the related fields are important activities. Grameen Shakti has installed 4 hybrid systems (combination of wind turbine and diesel generator) in four locations of the Grameen Bank, with little success.
Grameen Shakti is promoting bio-digester for cooking and to use residues in the field or in the ponds as an alternative to organic fertilizer.

Related Renewable Energy Services: Solar Energy, Wind Energy, Bio-Gas

Level of involvement in Renewable Energy Technology (RET): Planning, Implementation, Monitoring, Training, Finance to customer, Research.

Experience of RET Installation in Bangladesh: Solar PV System for house hold, Wind Turbine, Biogas Digester

System Present Condition: The System are performing very satisfactory. Only the fluorescents lamps got blackening problem. But this has been reduced by adaptive research. About 4 years have passed but no battery failure has been reported. Customers are happy with the overall performance of their PV systems.

Annual Budget on RET Installation: Annual budget of GS Tk. 5,22,72,020

b) Organization: Bangladesh Rural Advancement Committee(BRAC)

Type of organization: Non-Government Organization (NGO)

Address:
Business Address: BRAC Center, 75 Mohakhali, Dhaka-1212, Bangladesh
Tel: +88-02-988 1265, 882 4180, Ext. 2332
Fax: +88-02-882 3542, 882 6448
Web: www.brac.net
E-mail: development@brac.net, rdp@bdmail.net

Major functions of the organization: *Alleviation of poverty and empowerment of the poor, Projects includes:*
Education, Health care, Agriculture, Poultry, Poultry feed mill, Poultry disease, Diagnosis & feed analysis lab, Handy crafts, Renewable Energy Program (REP), Printing, Cold storage, Publications, Information Technology, Dairy and food Projects, Fisheries, Seeds Productions, Iodized salt production, Seri-culture, Tissues culture & Micro Credit.

Related Renewable Energy Services: Bio-Energy, Solar Energy, Wind Energy, Hot Box Cookers.

Level of involvement in Renewable Energy Technology (RETe): Planning, Monitoring, Finance, Implementation, Training & Research.

Experience of RET Installation in Bangladesh: Solar PV System, PV-Wind, PV Grid, Hot Box, and Biogas.

System Present Condition: Overall satisfactory, there is some failure of TL within short time.

Annual Budget on RET Installation: Taka 450,000.00

Additional Information: BRAC has targeted to install 10,000 Biogas Plants up to June 2004.

Organization: Center for Mass Education in Science (CMES)

Type of organization: Non-Government Organization (NGO)

Business Address:
Centre for Mass Education in Science (CMES)
House # 828, Road # 19 (old), Dhanmondi R/A, Dhaka-1209, Bangladesh
Tel: 88-02-811 1898; Fax: 88-02-801 3559
E-mail : cmes@citechco.net

Major functions of the organization:
Basic School System (BSS), Adolescent Girls` Program (AGP),

Priority wise activities: Research & Development, Installation, Manufacturing, System Design.

Related Renewable Energy Services: Solar Energy, Solar Thermal Technology.

Level of involvement in Renewable Energy Technology (RET): Planning, Monitoring, Finance, Implementation, Training & Research.

Experience of RET Installation in Bangladesh: Solar PV System, Solar Thermal Technology.

System Present Condition: Well.

Annual Budget on RET Installation: Taka 300,000.00

Organization: SHUBASHATI

Type of organization: Non-Government Organization (NGO)

Business Address:
House # 7, Main Road # 3, Block-A
Mirpur-11, Dhaka-1221
Bangladesh
Tel: 8116668
E-mail: shubashati@bol-online.com

Organization: Coast Trust

Type of organization: Non-Government Organization (NGO)

Business address:
Principal Office:
Charfession, Bhola 8340, Bangladesh
Dhaka Office: House # 9/4, Road # 2,
Shamoli, Dhaka-1207
Bangladesh
Tel:+88-02-8125181
Web: www.coasttrust.org

Major function of the organization:

- Level of Involvement in Renewable Energy Technology (RET):
- Experience of RET Installation in Bangladesh:

Organization: Srizony Bangladesh

Type of Organization: Non-Government Organization (NGO)
Business Address:
Srizony Bangladesh 2/7(3rd Floor) Block- E, Lalmatia
Dhaka-1207 Bangladesh
Tel:+88-02-912 8581
Email: srizonyb@accesstel.net, srizonyb@bttb.net.bd

Organization: Thangamara Mohila Sobuj Shangha (TMSS)

Type of organization: Non-Government Organization (NGO)
Business address:
631/5, West Kazipara
Mirpur, Dhaka
Bangladesh
Tel & Fax:+88-02-9009089
Mobile: 0189-212847
Email: tmss@accesstel.net,
Web:http://www.tmss-bd.org

Organization: Coastal Electrification and Women's Development Cooperative (CEWDC) or (UBOMUS)

Type of organization: Non-Government Co-operative.
Business address:
Principal Office:
Char Montaz, Patuakhali, Bangladesh
Dhaka Office: House # 4, Road # 6,
Block C, Banani, Dhaka-1207
Bangladesh
Major function of the organization: Rural electrification using off grid services for 7 years. Integrator of Solar Home System for the NGOs is in RERED program.

Level of Involvement in Renewable Energy Technology (RET): Micro-financing SHS as a PO to IDCOL.

Experience of RET Installation in Bangladesh: & unit offices in the southern part of the country. Installed and sold 700 SHS with micro-financing and after sales service.

h) Rahimafrooz Bangladesh Ltd

Type of organization: Private Company
Address: *Business address:* 705, West Nakhalpara, Tejgaon, Dhaka-1215, Bangladesh
Tel: 88-02-9113696, 9113522, 911 8163
Fax: 88-02-8115305, 956 8134
E-mail: sazzad@rahimafrooz.com **,**
http://www.rahimafrooz.com

Major functions of the Organization:
Rahimafrooz Batteries Limited, is the leading battery manufacturing company in Bangladesh. It manufactures and markets several types of batteries both in the local and international market. The Company, for more than 15 years, has been working in designing, marketing, supplying and installation of solar products for various types of uses e.g. Household lighting, Community lighting, off-grid market electrification, Railway signaling, Remote area communication etc. Rahimafrooz has installed more than 4187 SHS (50 Wp equivalent) in different parts of the country with installed capacity of 209 kWp (up to 2004).

Date of involvement in RET development: Since 1989.

Related Renewable Energy Services:
- Manufacturing
- System Design

- Research and Development
- Supervision

Level of involvement in Renewable Energy Technology (RET):
- Implementation
- Training
- Research
-

Experience of RET Installation in Bangladesh: Yes

Annual Budget on RET Installation: Tk. 50 Million (US$ 86,207)

i) Organization: SIEMENS/ Shell Solar (Bangladesh)

Type of Organization: Private company

Address:
Siemens Bangladesh Limited
Z. N. Tower Plot # 2
Gulshan Avenue / Road # 8
Gulshan Model Town (Gulshan - 1)
Dhaka - 1212
Tel: +88-02-9893536
Fax:+88-02-9893597
Email: jamil.rayhan@siemens.com.bd,
noor.uddin@siemens.com.bd
Web: www.shellsolar.com
www.siemenssolar.com

Major functions of the Organization: Providing complete solution for electrical & electronic engineering product & systems to the valued customers.

Organization: Prokaushali Sangsad Ltd

Type of Organization: Private Limited Company.

Business Address:
House no-4, Road no- 6, Block -c,
Banani, Dhaka-1213, Bangladesh
Tel: 880-2- 988 7356, 880-2-989 4023
Fax: 880-2-988 0501
E-mail: psl@bd.drik.net
Web: www.psldhaka.org

Experience of RET (Renewable Energy Technology) Installation in Bangladesh: Yes

Date of involvement in RET Development: 1 January' 1997

Priority Wise Activities: Research & Development, Installation, Manufacturing, System Design, Supervision, Consultancy.

Major functions of the Organization: PSL is Consultant to the Multilateral and bilateral organizations, GOB and others. It provides training and Capacity building on System design, Installation of RET system, Research & Development. Micro-enterprise and rural cooperative

development for SHS implementation, solar battery charging stations, imports 1400 solar modules from Kyocera, and promotes STECA controllers and CFL lamps to the NGOs and others.

Related Renewable Energy Services: Solar Energy, and Bio Energy.

Level of involvement in Renewable Energy Technology (RET): RERED project designs, market assessment for solar PV, feasibility study for SHS, national trainer for IDCOL program and consultant to REB solar program for Planning, Monitoring, Implementation, Training, Research.

Experience of RET Installation in Bangladesh: Solar Home System for 700 homes through UBMUS.

System Present Condition: All System are running smoothly over the years

Annual Budget on RET Activities: $300,000

Organization: Energy Systems

Type of Organization: Private Company

Business Address: House no-4, Road no- 6, Block -c, Banani. Dhaka-1213, Bangladesh
Tel: 880-2- 988 7356, 880-2-989 4023
Fax: 880-2-988 0501

Experience of RET (Renewable Energy Technology) Installation in Bangladesh: Yes in off-shore locations.

Date of involvement in RET Development: 1 January' 1995

Priority Wise Activities: Import of Solar hardware, Installation, Manufacturing, System Design, Supervision,

Major functions of the Organization: Solar Home System design, Installation of SHS, Solar pumping, Solar Water heater system, Research & Development.

Related Renewable Energy Services: Solar Energy

Level of involvement in Renewable Energy Technology (RET): Import of solar hardware, Installation of SHS, Distributorship of solar electronics, Monitoring, Implementation, Training, Research. Extensive experience in solar electronics.

Experience of RET Installation in Bangladesh: Solar Home System,

System Present Condition: All System installed in Cyclone shelters, rural communities and households are running smoothly over the years where GOB maintenance is available.

Annual Budget on RET Installation: Variable

Organization: Bangladesh Center for Advanced Studies(BCAS)

Type of Organization: Non-Government Organization (NGO)

Address: Bangladesh Centre for Advanced Studies (BCAS)
House # 10 (3rd Floor)
Road # 16/A, Gulshan- 1
Dhaka- 1212, Bangladesh
Tel: +88-02-885 1237, 885 2217, 885 1986
Cell: (Cell) 011-860052, 011-838356, 0171-862655.
Fax: +880-2-885 1417
E-mail: atiq.rahman@bcas.net, atiq.r@bdcom.com , info@bcas.net
Web: www.bcas.net

Major functions of the Organization: Working on resource management, Energy, Environment & Development and Sustainable Development Issues.

Related Renewable Energy Services: Bio-Energy, Solar Energy, Wind Energy.

Level of involvement in Renewable Energy Technology (RET): Planning, Monitoring, Finance, Implementation, Training, & Research.

Experience of RET Installation in Bangladesh: Solar PV System, Wind data, Wind, Irrigation, Biomass, Improve Stoves.

Annual Budget on RET Installation: Variable

Organization: Micro Electronics

Type of Organization: Private Company

Address:
Business address: Micro Electronics,
Basic Electronics Complex, 5th Floor,
1/1 Industrial Plot Avenue # 4,
Main Road # 3, Section # 7, Mirpur,
Dhaka-1216, Bangladesh,
Tel: 88-02-801-2244,801-2288, 900-5109, 900-511,
Fax:88-02-801-2266,
E-mail: micro2@dhakacom.com , micro@siriousbb.com
Web: www.microelectronics-bd.com

Major functions of the Organization: Micro Electronics has been working in Manufacturing, designing, marketing, supplying and installation of solar products for various types of uses e.g. Household lighting, Community lighting, Small Industries, Till date, Micro Electronics has been Commercially Provided Solar Home Lightings System.

Related Renewable Energy Services:

- Manufacturing
- System Design
- Research and Development
- Supervision

Level of involvement in Renewable Energy Technology (RET):

- Implementation
- Training

Experience of RET Installation in Bangladesh: Yes

3.3 Major Research & Development Organizations

1. Bangladesh Council for Scientific and Industrial Research (BCSIR)
2. Renewable Energy Research Center- University of Dhaka, Bangladesh
3. Center for Energy Studies, Bangladesh University of Engineering & Technology (BUET)
4. Bangladesh University of Engineering & Technology (BUET)-Lough Borough University (UK) Higher Education Link Project
5. Institute of Appropriate Technology (IAP), Bangladesh University of Engineering & Technology
6. Chittagong University of Engineering & Technology (CUET), Chittagong
7. Khulna University of Engineering & Technology (KUET), Khulna
8. Rajshahi University of Engineering & Technology(RUET), Rajshahi
9. Dhaka University of Engineering & Technology (DUET), Gazipur-Dhaka
10. Islamic University of Technology (IUT), Gazipur
11. Bangladesh Agriculture University, Mymensing

3.4 International Organizations (Donors)

World Bank
UNDP
GTZ(German Technical Cooperation)
SNV (Netherlands)
ADBs

ORGANIZATIONS WORKING ON STANDARDIZATION & TESTING

Technical Standards Committee of IDCOL has the mandate to:

- establish and update equipment and service standards,
- design a quality assurance program,
- determine technical standards for equipment to be financed,
- review the product credentials submitted by dealers, and approve the eligible equipment,
- and evaluate the feedback from dealers to develop the industry standards for the PV hardware equipment.

TESTING FACILITIES

For certification of hardware, a practical approach has been taken to address the issues in the context of prevailing conditions in Bangladesh, while typical international standards and certifications are well recognized. At present there is no official testing facility in Bangladesh for testing RET components. **Bangladesh University of Engineering and Technology (BUET)**, the major technical University in Dhaka, operates several well recognized testing facilities for quality certification including equipment, material, water testing and such other engineering aspects. BUET also offers extensive testing services to a variety of agencies and industries. BUET has a pool of experts familiar with international standards.

REB also manages its own testing laboratories for standard procedural quality control of rural electrification equipment.

Bangladesh Standards and Testing Institute (BSTI) is the main government organization for maintaining a record of all national standards and providing extensive testing facilities. Some other private organizations have also developed some facilities for simple verification and quality check of hardware

Table 1. List of Organisations working in the field of RET

GOVERNMENT ORGANIZATIONS	
Bangladesh Center for Scientific and Industrial Research	**SOLAR** • Solar Home Lighting System • Solar PV Water Pumping • Rotating shadowband Pyranometer(Solar Data Logging) • BIOMAS • Pilot Tests. Initials pilots based on floating Dome, then modified to fixed dome at BCSIR premises primarily vow dung feed based • Fixed Dome Type Field Operation – Full Routine Dissemination under Bio-Gas programs
Local Government Engineering Department	**SOLAR** • Solar Electrification in Tribal Community Center. • Solar Water pumping system at Prantik lake tourist resort under LGED • Solar Home Lighting System • Centralized Solar Electrification for Growth Centre • Cluster Village Solar Electrification, Sherpur • Solar PV System for Goznee Tourist Spot • Solar Water Purifier at LGED HQ • Solar Electrification in Rural Clinic • Solar Electrification at Ambaria UP Complex Bhaban • Solar Home Lighting System for Tribal Community & Bhudda Temple • Solar Electrification for IT development • Solar Photovoltaic Pumping **WIND** • Installation of the largest Wind-Solar Hybrid System which is 10 Wp in Saint Martin Island at Bay of Bengal. • Installation of slow speed high torque turbine • One small unit also installed at tourist resort Kuakata sea beach **MICROHYDRO** Bamerchara Micro Hydro Project
BPDB	**SOLAR** • Installation of 2x225 kw wind turbine power plant at patenga, cox's Bazar, Feni and kuakata having total capacity 1800 kw (pp) • Solar Power Plant at Chittagong hill tracts (pcp) • Feasibility Study of Solar Electric Power plant (TAPP)

	• Solar Electric Power Plant (PCP) • Energy Conservation pilot project (PCP) • Centralized solar PV power Plant (PCP) • Renewable Energy Hybrid power plant(PCP) • Electrification of Saintmartins Island by Renewable Energies (PCP) • Electrification of Dahogram and Angorpota by solar Energy (PCP) **WIND** • Implementing 10MW power plant from wind power at Muhuri Dam, at Feni district of Bangladesh • Installed wind turbine to produce 1MW power as pilot basis in order to reach target of 10MW
REB	**SOLAR** • Diffusion of Renewable Energy Technologies. • Diffusion of renewable energy technologies- 2nd phase. • Bangladesh Rural Electrification & Renewable Energy Development (PV component). • Promotion of renewable energy in rural area of Bangladesh • Karimpur & Nazarpur Unions of Narshingdi Sadar PS under Narshingdi District • Remote & off-grid areas of Austogram of Kishoreganj, Shingra of Natore, Kotalipara of Gopalganj, Moheshkhali, Kutubdia, Sandwip & St. Martins islands. • Remote & off-grid areas of Pabna PBS-2, Serajganj PBS, Natore PBS-2, Barisal PBS-1, Cox's Bazar & Sunamganj PBS.
PRIVATE ORGANIZATIONS: SOLAR	
SHELL(SIEMENS)	• Solar Housing System Installation • Solar Health Care Installation • Solar Lighting
MICRO Electronics	• Solar Lighting of cyclone shelters • Solar Home Lighting System
ENERGY SYSTEMS Prokaushali Sangsad Ltd	• Solar Lighting of cyclone shelters
RAHIMAFROOZ	• Community Based Rural Village Electrification in the hilly regions of Khagrachari district • Solar Home Lighting System

NGOs Working with Solar Home System under Government's RERED project executed by IDCOL

Name and Address	No of SHS Installed	Business Type	Sources of Components			
			Panel	Battery	Controller	Lamp
BRAC Foundation BRAC Center 75, Mohakhali Dhaka. Tel: 8824180	15279	Installation of SHS	Primary supplier: Rahimafrooz, Secondary supplier: Package from Women's Cooperative UBOMUS (using STECA controller and CFL lamps with Kyocera modules and Rimso battery			
COAST Trust House-9/4, Road-2 Shamoly, Dhaka Tel: 8125181	851	Installation of SHS	Package from Rahimafrooz			
CMES House-828,Rd-19(old) Dhanmondi, Dhaka Tel: 8111898	965	Installation of SHS, production of lamp, controller	Rahim Afrooz	Rimso	Self	Self
Grameen Shakti Grameen Bank Bhaban, Mirpur-2, Dhaka-1216, Bangladesh Tel:	More than 50500	Installation of SHS, production of lamp, controller	Kyocera, Astro Power, BP Solar	Rahim Afrooz	Self	Self
IDF House-8, Road-7, Block-F, Mirpur-2 Tel: 9005452	859	Installation of SHS	Package from Rahimafrooz			
Srizony Bangladesh 111, Pabahati Road, Pabahati, Jhenidah Tel: 0451-62497, 0451-63265	2504	Installation of SHS	Package from Rahimafrooz, UBOMUS			
			Kyocera	Rimso	Easy Electronics	
Shubashati House-7, Main Rd-3 Block-A, Section-11 Mirpur, Dhaka Tel: 9000026	851	Installation of SHS				
TMSS 631/5 Kazipara, Mirpur, Dhaka Tel: 9009089	842	Installation of SHS	Package from Rahimafrooz, UBOMUS			
UBOMUS Dhaka Office House-4, Road-4 Block-C, Banani Tel: 9887356	693	Installation of SHS, production of lamp, controller, Supply of SHS components	Kyocera	Rimso	Steca	Steca
Singer House-5B, road-126 Gulshan 1 Tel: 8825864	44		Kyocera	Rimso	UBOMUS	
DORP	22					

Name and Address	No of SHS Installed	Business Type	Sources of Components			
			Panel	Battery	Controller	Lamp
152/2-I Green Road, Panthapath, Dhaka Tel: 9130101						
BRIDGE House-	48					
PMUK House-548, Road-10 Baitul Aman Housing Society, Adabor. Tel: 8151124-6	1					

Table 2. Completed and ongoing donor projects of RET

Project Name	Source of Funding	Implementing Organization	Duration	Result
RET's in Asia	SIDA (Sweden)	CMES; Grameen Shakti; BIT (Khulna)	1997-2003	Report
Electricity through Micro utility Using Solar PV Technology	USCCB (Canada)	CMES	2001-2002	Report
Water Disinfections Using Solar Thermal Technology (SODIS Method)	USCCB (Canada)	CMES		Report
Development of Solar PV Accessories for Local Market	USAID	Grameen Shakti		
Solar and Wind Energy Resource Assessment (SWERA)	USAID-NREL	University of Dhaka	2002-2006	Report under preparation

4. Supplier of SHS Components:

Almost 100% of the SHS components except PV modules and tubes are now being produced in Bangladesh. The amount of import of charge controllers, lamps, batteries and cables used for SHS is Negligible. From the interviews with stakeholders, it may be concluded that fully assembled products from abroad have little chance to sustain in the market, because of possible higher price, difficulty of providing maintenance and warranty service, etc. However, they would all welcome quality products at competitive prices. Specially, they welcome quality battery, since they are at the moment dependent on very few manufacturers where one of them has a near monopoly market.

Information on Solar Modules used in Bangladesh

Producer	Country of origin	Importing Organization	End users
BP/TATA-BP	India	Rahimafrooz Batteries Ltd.	BRAC, Grameen Shakti, Srizony, COAST, Government users, other clients
Astro power	U.S.A	Grameen Shakti	Grameen Shakti
Siemens	U.S.A	Grameen Shakti, siemens Bangladesh Ltd.	Grameen Shakti
Siemens	Germany	Siemens Bangladesh Ltd.	REB, other users
Kyocera	Japan	Grameen Shakti, UBOMUS	RERED projects
Atersa	Spain	Microelectronics Ltd	Srizony, other users
Iso photon	Spain	Microelectronics Ltd	

Batteries:

In Bangladesh there is local capacity for manufacturing batteries of variety of quality and longevity, mainly for automotive applications. The manufacturers provide one to two years performance warranties for automotive batteries. One of the manufacturers is producing internationally competitive industrial batteries. These batteries are typically selected for SHS projects and carry a five year manufacturer's warranty. There are other battery manufacturers in the country catering mainly automotive industry and various local user working in smaller scale. The raw materials for manufacturing batteries are imported by larger companies for own use and for supplying to smaller manufactures. Some organizations are also importing specialized batteries for specific client need.

Locally manufactured industrial batteries used for SHSs

Manufacturer	Country of Origin	Quantity					
		2000	2001	2002	2003	2004	2005
Rahimafrooz Batteries Ltd	Bangladesh	4395	5682	5695			
Microelectronics Ltd	Bangladesh	325	435	560			
Rimso Battery & Co.	Bangladesh	-	-	40	500	1100	2350
Navana Battery							

Retail Price of Batteries being used for SHS in Bangladesh

Manufacturer	Certification	Retail Price		
		60 Ah	80 Ah	100 Ah
Rahimafrooz Batteries Ltd	BUET/ ISO9001	5700	7850	8770
Rimso Batteries & Co.	BUET	5000	6500	8000
Navana Batteries				

DC Lamps

Lamps constitute the major appliance for the SHS apart from occasional use of radio, cassette recorder and TV. Standard fluorescent tubes of 6 W, 8 W, 10 W, 13 W, 20 W and others are available in the market for use with DC ballast. Locally manufactured lamps are being used in the ongoing SHS and off-grid electrification projects.

DC lamps were not available for home lighting. The only DC lamps available in the country were designed for automotive use, which did not have stringent requirement for energy efficiency as car batteries are being charged continuously. With initiation of SHS programs, local assembly of Dc lamps was started by private sector organizations and NGOs. Intensive research was carried out in the country to design lamps that integrate both energy efficiency and high lumens per watt, at the same time become affordable for the rural populations The ballasts for these lamps are now manufactured using electronic components and other locally made components.

DC Lamps for SHSs

Manufacturer	Country of origin	Production Volume (in Number)					
		2000	2001	2002	2003	2004	2005
Grameen Shakti	Bangladesh	5808	10546	15523			
UBOMUS	Bangladesh	50	600	300		1000	3000
Innovative Technologies Ltd.	Bangladesh	1088	1575	3850			
Microelectronics	Bangladesh	175	336	1150			
CMES	Bangladesh	136	136	146			
Sundaya	Indonesia	N/A	N/A	N/A	N/A	N/A	N/A
Solsum	Germany	N/A	N/A	N/A	N/A	N/A	N/A
Others		N/A	N/A	N/A	N/A	N/A	N/A

Price of Lamp consists of the electronic ballast/shade and the fluorescent tubes. Warranty provided by the manufacturers/ suppliers usually does not cover the tube, which is treated as a consumable item.

Retail Price of DC Lamp including fluorescent tubes

Supplier	Country of origin	Certification	Retail Price (Taka)
Grameen Shakti	Bangladesh	BUET	550
UBOMUS	Bangladesh	BUET	
Innovative Technologies Ltd	Bangladesh	BUET	800
Microelectronics	Bangladesh	BUET	600
Sundaya	Indonesia	BUET	N/A

Retail Price of fluorescent tubes

Supplier	Country of Origin	Retail price per piece (Taka)		
		6W	8W	10W
Toshiba	Japan	50	65	75
Toshiba	Singapore	48	60	70
Philips	Netherlands	50	65	70
Philips	China	47	58	65
DOP	Indonesia	50	60	68
OSRAM	Germany	55	65	70

Charge Controller

Charge controllers for Solar systems are being assembled in the country by a small number of organizations. Most of these are locally designed and use electronic components available in the local market. A very high quality charge controller is being assembled by CEWDC (UBMUS), a local women's cooperative which imports all the components, including a patented Integrated Circuit, directly from German manufacturer under its license.

Supply of Charge Controllers

Manufacturer	**Country of Origin**	**Quantity**					
		2000	2001	2002	2003	2004	2005
Grameen Shakti	Bangladesh	1760	3196	4704			
Steca/ UBOMUS	Germany/ Bangladesh			6	1256	1963	1250
Innovative Technologies Ltd	Bangladesh	320	450	1120	1200		
CMES	Bangladesh	40	40	40	30		
Microelectronics	Bangladesh	50	80	230	740		
Morning Star	U.S.A						
Sundaya	Indonesia						

Price of controllers available in the market varies with the type and quality of the products. Local products are cheaper but there is a concern that they may not deliver services expected from good charge controllers, i.e. longevity of the batteries and lamps.

Retail price of Charge Controllers

Manufacturer	**Country of origin**	**Certification**	**Retail price (Taka)**
Grameen Shakti	Bangladesh	BUET	500
Steca/CEWDC	Germany/ Bangladesh	ISO 9001, TUEV	1050
Innovative Technologies Ltd	Bangladesh	BUET	
Microelectronics	Bangladesh	BUET	
Morning Star	U.S.A	ISO 9001	
Sundaya	Indonesia	BUET	
Steca	Germany		

Cable

Bangladesh has been manufacturing electrical cables for a long time. There are many companies producing cables of various specifications mainly for the construction and equipment industry. Good quality and specific sizes of cables are required for the typical solar systems in use.

Supply of cables for SHSs

Producer	Country of Origin	Quantity (in meter)					
		2000	2001	2002	2003	2004	2005
BRB Cable	Bangladesh	19600	31960	47040			
Paradise Cable	Bangladesh	15000	12000	11000			

Producer	Country of Origin	Quantity (in meter)					
		2000	2001	2002	2003	2004	2005
Super Sign Cable	Bangladesh	3000	3500	2750			
Others	Bangladesh	4000	4500	3500			

Retail Price of Cables used for SHSs

1 Producer	Country of Origin	Certification	Retail Price per meter
BRB Cable	Bangladesh	ISO 9001, 9002	
Paradise Cable	Bangladesh	ISO 9001, 9002	
Super Sign Cable	Bangladesh	ISO 9001, 9002	
Eastern Cable	Bangladesh	ISO 9001, 9002	
Easin Cable	Bangladesh	ISO 9001	

Suppliers of Parts:

Although all the components used in the country are currently produced in Bangladesh, their parts are almost 100% of foreign origin. UBOMUS procures complete kits from Steca Germany for the assembly of Steca Charge controllers to ensure quality of components. Microelectronics Ltd. imports directly up to 70% of their parts from abroad. Microelectronics is one of the biggest electronics goods manufacturers in Bangladesh and has existing linkages for direct import of components. Manufactures like Grameen Shakti, Innovative Technologies Ltd., CMES do not Import themselves, but procure their parts from local market. Local market is being supplied by importers and the goods are of different origin. The quality of the imported components is also variable and can sometimes be unreliable. The cable manufacturers generally import their required raw materials themselves. The table below shows countries from where importing organizations procure their parts and raw materials.

Import of parts/ raw materials for SHSs

Items	Country of Origin	Importing Organizations
Charge Controller parts	India, China, Taiwan, Germany, Malaysia	UBOMUS, suppliers of local market
DC lamp parts	India, China, Taiwan, Malaysia, Korea, Japan	Suppliers of Local market
Electronics parts	India, China, Taiwan, Malaysia, Korea, Japan	Suppliers of local market
Battery raw materials	India, China, Taiwan, Malaysia, Korea, Japan, UK, Australia	Microelctronics Ltd., Rahimafrooz Batteries Ltd
Cable parts/ Raw materials	India, China, Taiwan, Malaysia, Korea, Japan	BRB Cable, Paradise cable, Eastern cable, Supersign cable, Easin cable

5. Research and Development on RET in Bangladesh

Different Institutes, Universities and Research organizations (both public and private) are carrying out Research and Development (R&D) activities on diversified fields of renewable energy technologies. R&D activities of Bangladesh are characterized by plethora of constraints, including lack of expert manpower and financial resources. Different organizations and their field of interest related to R&D of RETs are presented in the following table.

Technology	Involved Organization	Remarks
Solar Photovoltaic/ Balance of system	Grameen Shakti, CMES, IFRD, BUET	It is possible to manufacture all the balance of system components (like Charge controller, Cable, Inverter, Converter etc.) locally
Solar Water Heaters	RERC, Dhaka University, IFRD, CMES	It is possible to manufacture with local design and fabrication facilities.
Improved Stoves	IFRD	Number of designs have been development at IFRD with three basic categories- (I) improved stove without chimney (II) improved stove with chimney and (III) improved stove with waste heat utilization.
Solar Cooker-Parabolic	IFRD, ANANDO	IFRD has successfully field-tested it's design which can quickly raise water to boiling point under clear sunny days. ANANDO is also manufacturing and marketing it's products with imported materials and design.
Solar Cooker-Box Type	IFRD, CMES	IFRD's design is made of locally available raw materials. The manufacturing cost of such a cooker is about Tk. 800.00 excluding the cost of utensils. The cookers are now being sold at IFRD.
Solar Dryer	IFRD, BRRI, BAU	Different types have been designed and tested with locally available materials.
Solar Wood Seasoning Plant	BFRI	A simple, inexpensive and effective solar kiln has been developed for seasoning timber using solar radiation. The kiln can be constructed conveniently with locally available materials. Timbers of different species and dimensions can be seasoned throughout the year in the solar kiln.
Solar Passive Architecture	BCSIR	A solar house has been designed and built in the BCSIR campus, the purpose is to keep the house warm in winter and cool in summer.
Briquette Machine	BIT Khulna, BRRI	Under the "RET in Asia" program, BIT Khulna is developing better machines with longer screw life.

Biogas	IFRD, LGED, BAU	Fixed-Dome type plants are indigenously designed and constructed
Water Current Turbine	Department of Mechanical Engineering (DME), BUET	DME, BUET is studying a model water current turbine for harnessing energy from river current and in the process of developing a prototype.
Wind Turbines	BUET	Computational models are developed for simulation of Horizontal and Vertical Axis Wind Turbines.

6. Financing Of Renewable Energy Projects

Source of Financing is often one of the major barriers before implementing environmentally benign Renewable Energy Technologies (RETs) in Bangladesh. Currently, there are two major funds, from Global Environment Facility (GEF) & Clean Development Mechanism (CDM), which can be accessed for financing such projects in Bangladesh which can be utilized for overall development of society, environment and economy.

In 1998, The Government of Bangladesh (GOB) lifted import duty and Value Added Tax (VAT) from solar photovoltaic and wind turbines. Solar PV program of different government bodies (BPDB, LGED, REB) are basically subsidy driven. Till 2005 the Biogas Pilot Plant project, the Government of Bangladesh (GOB) gave 7,500 Taka subsidy for a family-size biogas plant which can be used for cooking and lighting purposes.

Financing mechanisms of different renewable energy technologies are described in the subsequent headings.

1. Biogas Plants

Till 2004 under the Biogas Pilot Plant project, the Government of Bangladesh (GOB) gives 7,500 Taka subsidies for a family-size biogas plant which can be used for cooking and lighting.

2. Solar Home Systems (SHS)

Currently different financing mechanisms are available for Solar Home Systems . Mainly there are three types:
Rural Electrification and Renewable Energy Development Project (REREDP). Under this $20 million project, IDCOL's original mission expanded to include the promotion of solar home systems (SHSs) and other renewable energy projects such as mini-hydro, wind and biomass. To support the program, joint financing is provided thereto by IDA and Global Environment Facility (GEF);
The fee-for-service option (implemented by REB Narsingdi 62kW Solar Photovoltaic Project and will be replicated in other off-grid areas in the future projects);
Credit Sell option (implemented by Grameen Shakti, LGED, BPDB);
Cash Sell (implemented by Grameen Shakti and different dealers).

3. Fee-for-Service Scheme

About 800 Solar Photovoltaic units of five systems ranging from 6 to 92 Wp have been supplied or installed in the 62kW Solar Photovoltaic Project at Narsingdi. 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.

LGED and CMES has also tried to investigate the fee-for-service option in remote market places and found satisfactory results.

4. Credit Program of Grameen Shakti

GS offer the following four credit modes for those who want to buy the system on credit.
Mode-1:
The customer has to pay 15% of the total price as down payment.
The remaining 85% of the cost are to be repaid within 36 months with 12% service charge.
Mode-2:
The customer has to pay 25% of the total price as down payment.
The remaining 75% of the cost are to be repaid within 24 months with 8% service charge.
Mode-3:
The customer has to pay 15% of the total price as down payment.
The remaining 85% of the loan amount including 10% service charges are to be repaid by 36 account payee cheques in advance.
Mode-4:
4% discount is allowed on listed price in case of cash purchase.
Subsidized Credit Sell:

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

5. Small Wind Turbines

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

6. Developing Partners (Donors) involved RET Project Financing in Bangladesh

World Bank (www.worldbank.org.bd)

UNDP (http://www.un-bd.org)

GTZ - German Technical Cooperation (http://www.gtz.de/en/weltweit/asien-pazifik/604.htm)

Asian Development Bank (http://www.adb.org/Bangladesh/default.asp)

SNV (The Netherlands)