

RENEWABLE ENERGY DEVELOPMENT IN BANGLADESH

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**Executive Exchange on the use and integration of Renewable Energy in the
Power Sector**

Madrid, Spain

October 19 – 23, 2009



COUNTRY PROFILE OF BANGLADESH

Geographical location	:Between 20°34' and 26°38' North latitude, 88°01' and 92°41' East longitude
Area	:147 570 sq. km. [land: 130,168 sq km; water: 13,830 sq km]
Land type	:Consists mostly flat alluvial plain; hilly in southeast
Population	:161.915 Million (2008)
Population density	: 1101.9 per km ² (2007)
Population growth rate	:1.7% (2009 est.)
Sex ratio	: 1.04 male(s) to female (2008)
Infant mortality rate	: 52.5 deaths/1,000 live births
Life expectancy rate	:63.1 years
Ethnics groups	:Bengali -98%, Others (tribal groups, non-Bengali Muslims) -2%
Religions	:Muslim 83%, Hindu 16%, Other 1%
Languages	:Bengali(official), English
Literacy rate	:47.9% (male-54%, female: 41.4%) (2001 Census)



MACROECONOMIC INDICATORS OF BANGLADESH

Currency	:Taka (BDT) ; USD 1 = 70 BDT
Purchasing power	:\$224 billion (2008 est.)
GDP per capita	:US\$ 506.054 (2008)
GDP growth rate	:5.587 % (2008)
Industrial production growth rate	:6.9% (2008 est.)
Inflation rate	:8.357 % (2008)
Population below poverty line	:45% (2004 est.)
Unemployment rate	:2.5% (2008 est.)
Labor force	:70.86 million
Industries	:Cotton textiles, jute, garments, tea processing, paper newsprint, cement, chemical fertilizer, light engineering, sugar.



ENERGY INDICATORS OF BANGLADESH

Total energy consumption	:16.6 million tons oil equivalent
Per capita energy consumption	:171 kg oil equivalent
Energy related CO2 emission	:42.74 million metric tonnes
Per capital CO2 emission	:0.3 metric tonnes
Energy consumption	: Conventional energy (54%) , Biomass (46%)
Conventional energy consumption	: Natural gas: 1850-1900 Millions of standard cubic feet per day (April 2009) Oil: 3.5 Metric Tonnes (2008) Coal: 3.8 Metric Tonnes (2008)
Access to electricity	: 45%
Per capital electricity consumption	: 145 kilowatt per hour per annum
Present electricity demand	: 4200 ~ 5500 MW
Present Available Generation	:3800 ~ 4200 MW
Maximum Load Shedding in FY-09	:1270 MW (April 23, 09)



CASE FOR RENEWABLE ENERGY

- ★ To ensure energy security
 - 70% of Bangladesh's total commercial energy is provided by natural gas and the remainder almost entirely provided by imported oil, hydropower and coal.
 - Present proven reserves of indigenous gas will be exhausted by 2030
 - Load shedding will be 1750 MW by 2014 and with gas supply uncertainty it may be more than 3000 MW.
- ★ To reduce negative environmental consequences
 - Climatic change will eventually raise the sea level . One meter sea level elevation will inundate more than 15% of Bangladesh, displacing more than 13 million people.
- ★ To supplement Government's vision on:
 - Electricity for all by 2020.
 - Government has set a target to meet 5% of total power demand by 2015 and 10% of total power demand by 2020 from renewable energy sources.
- ★ To reach out to off-grid areas where grid electricity is not available



POTENTIAL OF RE IN BANGLADESH

Sources of RE	Technological Potential
Solar photovoltaic	<ul style="list-style-type: none">▪ Solar energy can be generated in all parts of Bangladesh.▪ Daily average solar radiation varies between 4 to 6.5 kWh per square meter.▪ Solar energy can be utilized in two ways: by converting it into heat (solar thermal) or electricity (solar PV).▪ Solar PV has been harnessed more in Bangladesh than Solar Thermal: SHSs (99.9%), others (solar pumping, solar lighting, solar mini-grid and others-0.1%).▪ 400,000 SHSs have been installed under IDCOL Solar programme and about 50,000 have been installed by others i.e. LGED, REB, BPDB and other NGOs
Biogas	<ul style="list-style-type: none">▪ There are 3 million potential households with adequate cattle/poultry.▪ Biogas is being used for cooking purpose.▪ About 41,000 biogas plants has been installed in Bangladesh by different NGOs under NDBMP program of IDCOL, SED program of GTZ, and other government organizations i.e. LGED, BCSIR.▪ Approximately 1 MW biogas based electricity plant has been installed.▪ There is potential for 800 MW.



POTENTIAL OF RENEWABLE ENERGY DEVELOPMENT IN BANGLADESH

Sources of RE

Technological Potential

Biomass

- About 8 - 9 million metric tons of rice husk annually.
- There is potential to generate 400 MW electricity.
- IDCOL has financed installation of a 250-kW biomass gasification based power plant in off-grid area.

Wind Energy

- No comprehensive wind mapping has been conducted.
- The potential is assumed to be limited to coastal areas, and offshore islands.
- 1 wind turbine - 1 MW capacity each - at Kutubdia by BPDB has been installed.

Hydro

- Microhydro and minihydro have potential only in hill tract areas.
- Assessments have found few potential sites for building small capacity power plants 10 kW to 5MW.
- LGED study identified eight potential micro-hydro sites in Chittagong Hill Tract with a total estimated capacity of 135 kW.



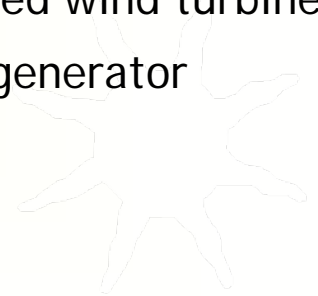
RENEWABLE ENERGY DEVELOPMENT IN BANGLADESH AT A GLANCE

RETs which have found wide scale use in Bangladesh are shown below:

Technology	Number of units
Solar Home System	Above 450,000
Improved cooking stoves	Around 400,000
Biogas Plants	Around 41,000

Following renewable energy technologies have also been explored:

- Biogas based electricity
- Biomass gasification based power plant
- Solar water heaters
- Solar dryers
- Solar cookers
- Water lifting wind turbine
- Wind electricity generators
- Hybrid generators
- Grid connected wind turbine
- Micro hydro generator
- LED lamps





PIONEERING ORGANIZATIONS IN PROMOTING RE SECTOR OF BANGLADESH

Donors	Promoters	Manufacturers	MFI/NGO/Private companies
▪ The World Bank	▪ LGED	▪ Rahimafrooz	▪ Grameen Shakti
▪ GEF, KfW, GTZ	▪ REB	▪ Hamko, Rimso, Navana, Hamko, Panna and J.Co	▪ RSF
▪ SNV	▪ BPDB	▪ Innovative Technologies, Grameen Shakti, Easy Electronics, MSi Technology, Technosol, CMES, Energypac	▪ BRAC
▪ ADB, IDB	▪ IDCOL*	▪ BCSIR, BRAC, Advance Technology, Palli Shakti	▪ SRIZONY, UBOMOUS, BRIDGE, Hilful Fuzul, COAST, IDF, CMES
▪ UNDP, USAID		▪ BUET, KUET, UIU	▪ Dreams Power Pvt. Ltd.

* The only local financial institution working in RE sector in Bangladesh.



MAJOR R&D ACTIVITIES FOR RENEWABLE ENERGY TECHNOLOGIES IN BANGLADESH

Technology	Major Organizations	Remarks
Solar Photovoltaic/ Balance of system	LGED, RERC, GS, CMES, BAU, BUET, UIU, Rahimafrooz, Micro Electronics, Energy Systems, Innovative Technologies, Grameen Shakti, Easy Electronics, MSi Technology, Technosol, CMES, Energypac, Rimso, Navana, Hamko, Panna and J.Co, etc.	Manufacture of all the balance of system components (like Charge controller, Cable, Battery, Inverter, Converter etc.).
Solar Water Heaters	RERC, BCSIR	Local design, fabrication and installation.
Improved Stoves	BCSIR, BRAC	Number of designs have been developed at BCSIR with three basic categories-(I) without chimney (II) with chimney (III) with waste heat utilization.
Solar Cooker- Parabolic	BCSIR	BCSIR has successfully field -tested its design which can quickly raise water to boiling point under clear sunny days.
Solar Cooker- Box Type	RERC, BCSIR, BRAC, CMES	The cooker is made of locally available raw materials.
Solar Dryer	RERC, BCSIR, BRRI, BAU	Different types have been designed and tested with locally available materials.
Solar wood Seasoning	BFRI	A simple, inexpensive and effective solar kiln has been developed.
Briquetting Machine	KUET, BRRI	Under the "RET in Asia" program, BIT Khulna is developing better machines with longer screw life.
Biogas	BCSIR, LGED, BAU, BRAC, Grameen Shakti, IDCOL	Fixed-dome type plants are indigenously designed and constructed.



MAJOR RE PROMOTERS OF RE IN BANGLADESH

Grameen Shakti	<ul style="list-style-type: none">▪ One of the largest and fastest growing rural based renewable energy companies in the world;▪ Installed about 250,000 SHSs, 50,000 ICSs, and 8,000 biogas plants.
LGED	<ul style="list-style-type: none">▪ Demonstrates diversified applications of renewable energy technologies and contributes in capacity building;▪ Installed 3,000 biogas plants, 600 SHSs and conducted studies on hydro and wind potential.
REB	<ul style="list-style-type: none">▪ Installed 806 SHSs in 1996-97 two riverine islands , generating 62 KWp power;▪ Installed about 12,000 SHSs in remote rural areas.
BPDB	<ul style="list-style-type: none">▪ Implemented projects of wind, solar and small hydro at remote locations where grid electricity could not be reached;▪ 1 wind turbine - 1 MW capacity each - at Kutubdia by BPDB has been installed;▪ Installed solar household system of total 54 kw p in off grid rural area.

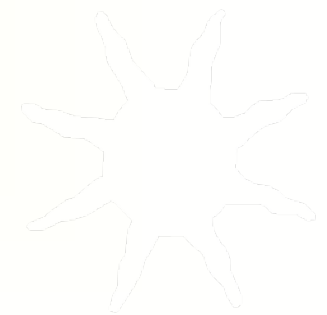


AN OVERVIEW OF IDCOL

- IDCOL is a Government-owned financial institution mandated to promote private sector financing in infrastructure and renewable energy sector.
- It provides long-term financing to private sector infrastructure projects and RE Projects.
- It has invested USD 66 million in the RE sector (33% of the total investment portfolio) and USD 103 million (52% of the total investment portfolio) in the power sector

Objectives:

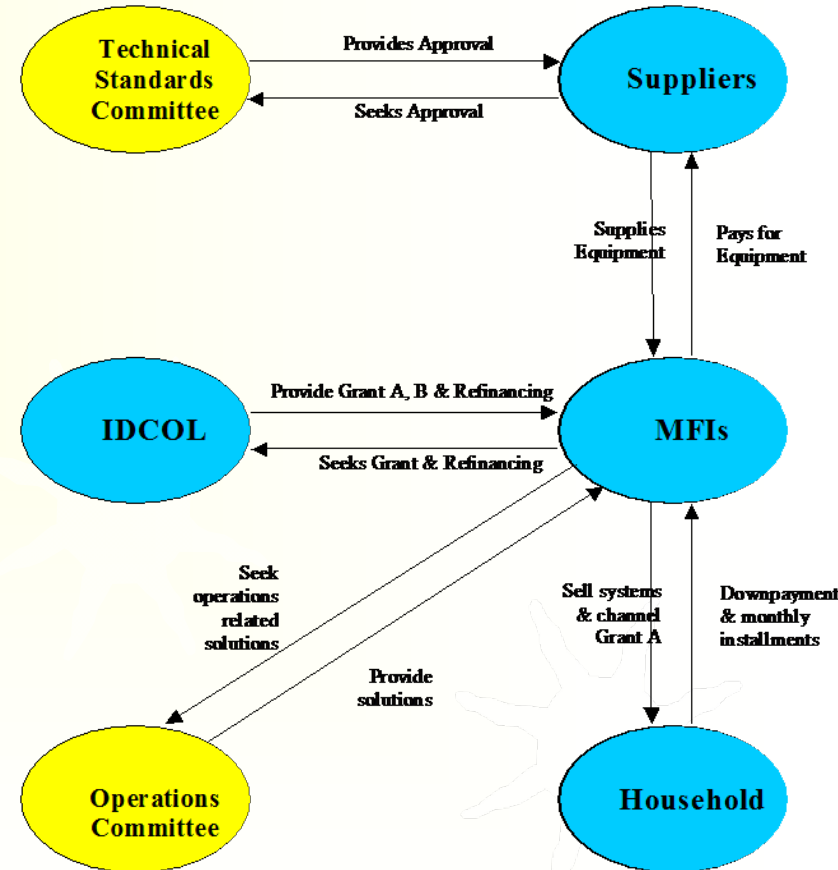
- Promoting renewable energy technologies in Bangladesh.
- Fulfilling the basic electricity requirements in the rural areas of Bangladesh and supplementing the Government's vision of electrifying the whole Bangladesh by the year of 2020.
- Promoting renewable energy businesses in Bangladesh on commercial basis.
- Ensuring environmental sustainability.
- Encouraging micro-finance and income generation activities.
- Raising standard of living of rural people through RE.
- The RE portfolio includes Solar Program, Biogas Program (NDBMP), a 250-kW Biomass gasification based power plant.





IDCOL SOLAR PROGRAMME – AT A GLANCE

- With the help of IDA, GEF, the Program started as a key component of the Rural Electrification and Renewable Energy Development Project (REREDP) of The World Bank;
- The initial target of installing 50,000 Solar Home Systems (SHSs) was achieved through 15 Partner Organizations in August 2005, 3 years ahead of completion date and USD 2 million below the estimated cost.
- Following the success, IDA, GTZ, KfW, ADB and IDB have extended support.
- IDCOL has revised its target to 1 million SHS by 2012.
- About 400,000 SHSs (21.56 MW) have been installed under the program which has contributed to the 74,800 tCO2 emission reduction of tonne per annum.
- It is one of the fastest growing renewable energy programs in the world.





NATIONAL DOMESTIC BIOGAS AND MANURE PROGRAM (NDBMP)

- The program is being implemented with financial assistance from SNV Netherlands and KfW.
- IDCOL provides grant & also refines loan extended to the customers.
- IDCOL also extends technical assistance to its Partners.
- 30 NGOs/MFIs/private firms (PO) are implementing this.
- Under the project, a total of 60,000 domestic sized biogas plants are planned to be constructed by 2010.
- About 9000 biogas plants have been constructed under the program.



BIOMASS POWER PLANT

- A 250-kW biomass gasification based power plant has been constructed in Kapasia, Gazipur under World Bank project.
- IDCOL provided financial and technical assistance for implementation of the project.
- The Plant has been sponsored by a private entity Dreams Power Ltd.
- The plant uses rice husk as fuel for power generation.
- Being located in off-grid area it is supplying grid quality electricity to 300 households and commercial entities.
- It was a pilot project which will be replicated in areas where rice production is high.



OTHER RENEWABLE ENERGY PROJECTS IN PROGRESS

Proposed RE Programme	Technology	Expected Socio-economic impact
400-kW Biomass gasification based power plant	Biomass gasification	<ul style="list-style-type: none">▪ 15-20 rice mills, 30 irrigation pumps, and several other small and medium enterprises will be supplied electricity to replace grid electricity currently being used.
100-kW Solar-wind Micro- Grid 5-kW Solar Power Mini-grid	Solar-wind Solar Photovoltaic	<ul style="list-style-type: none">▪ Will supply electricity to marketplace, nearby households, few health centers and school in remote off-grid area.▪ 100 potential households in off-grid areas will be connected.
Two Solar Water Pump for Irrigation	Solar Photovoltaic	<ul style="list-style-type: none">▪ A total of 140 solar panels with 130-Wp capacity each will provide the required power to run the pump▪ Will replace 160,000 liter of diesel and thus, and will save 444,800 tons of CO2 emission reduction during the Project life
5-MW Solar Manufacturing Plant	Solar PV	<ul style="list-style-type: none">▪ Satisfy local demand, will alleviate supply crisis▪ Reduce system price, generate employment▪ Will induce faster expansion of SHSs and will generate export earnings



IDCOL'S TARGET UP TO 2012

	Average Capacity	Installation target	Total Capacity
Solar Home System	54 W	1 million	54 MW
Biogas Plant for cooking gas	2.6 m ³	60,000	48 MW
Solar Mini Grid	50 KW	20	1 MW
Solar Irrigation Pump (1 Cusec)	5 KW	30,000	150 MW*
Biogas based Power Plant	50 KW	500	25 MW
Biomass Based Power Plant	400 KW	10	4 MW
Total Potential			282 MW

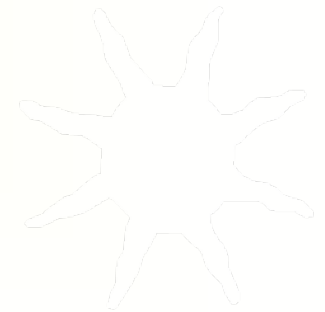
- IDCOL is in the process of creating a model for Solar Irrigation Systems (SISs) similar to the SHS program



POTENTIAL RENEWABLES IN BANGLADESH

★ Other potential renewable energy sources yet to be explored include:

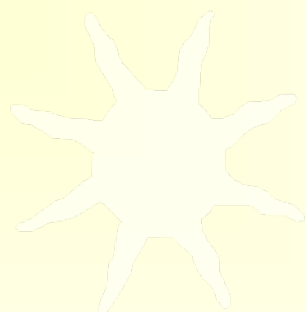
- Solar Thermal Power/Concentrating Solar Power (CSP)
- Bio-fuels
- Gasohol
- Geothermal,
- River current
- Wave and tidal energy



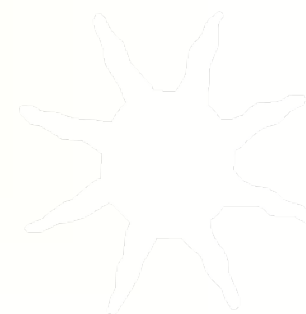


ROLE PLAYED BY THE GOVERNMENT

- Renewable Energy Policy has been adopted by the Government of Bangladesh on 18 December 2008.
- The policy has set a target of generating 5% of the total electricity from renewable sources by 2015 and 10% by 2020.
- A focal point called Sustainable Energy Development Agency (SEDA) will coordinate activities related to the development of renewable energy technologies and financing mechanisms.
- For electricity less than 5 MW generated from renewable energy projects may be purchased by power utilities or any consumer.
- All renewable energy equipments and related raw materials will be exempt from 15% VAT and companies will be exempt from corporate income tax for a period of 5 years;
- Private sector participation including joint venture initiatives in renewable energy development will be encouraged and promoted;
- An incentive tariff has been proposed for electricity generated from renewable sources which may be 10% higher than the highest purchase price of electricity.
- Bangladesh Bank, the Central Bank, has launched a revolving fund of BDT 2 billion for refinancing renewable energy projects i.e. solar energy, biogas and effluent treatment plants through commercials at concessionary terms and conditions.



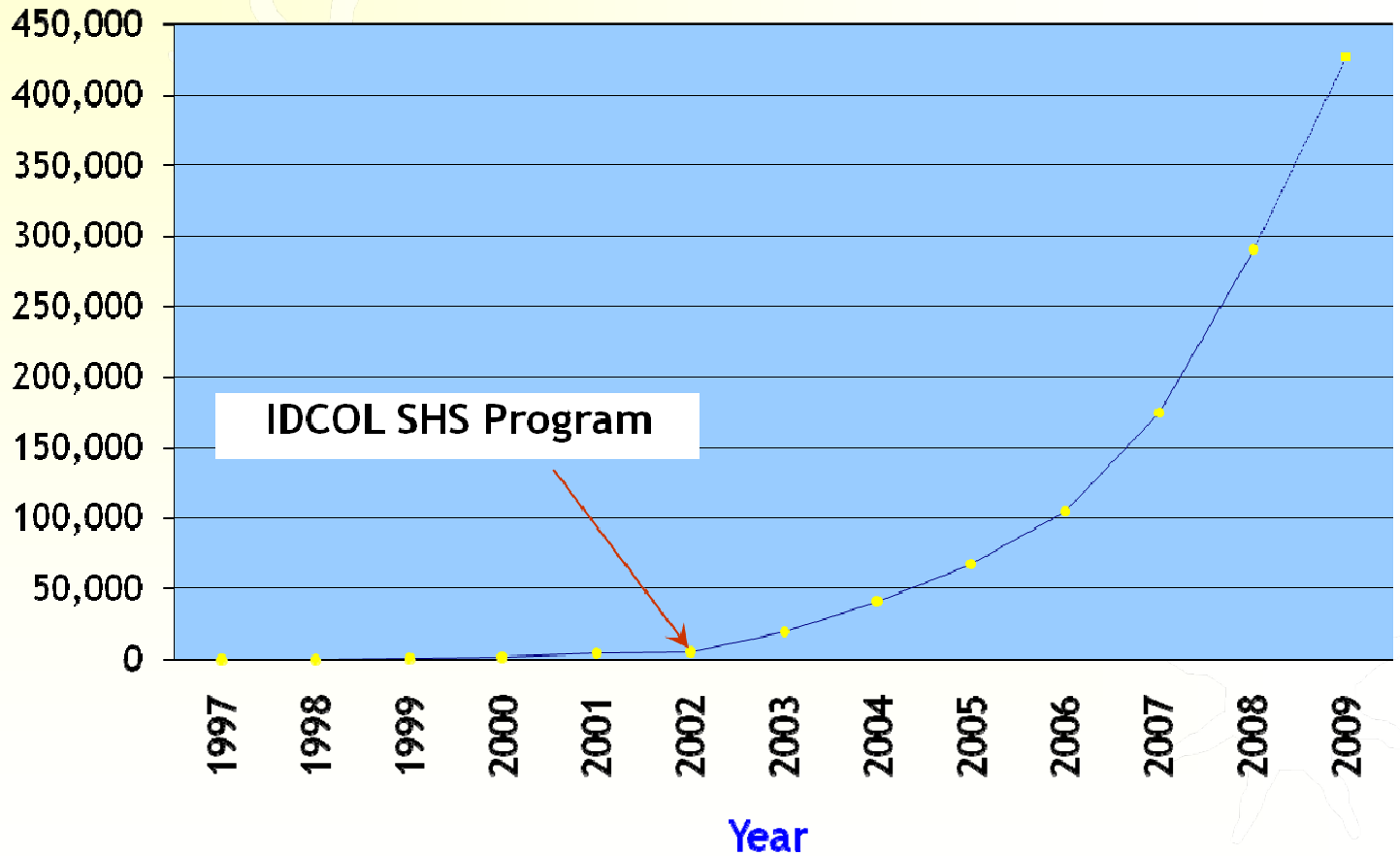
THANK YOU





SHS INSTALLATIONS IN BANGLADESH

Number of SHS





IDCOL'S RENEWABLE ENERGY PROGRAM

- IDCOL is a financial institution owned by the Government. It provides long-term financing to private sector infrastructure projects and RE Projects.
- Current RE programs include:

Programmes	Supported by	Achievement
IDCOL Solar Home Systems Programme	World Bank, KfW, GTZ, ADB	▪ 400,000 SHSs-equivalent to 21.56 MW electricity, -have been installed around the country.
National Domestic Biogas and Manure Programme	SNV, KfW	▪ 9,000 biogas have been installed.
250-kW Biomass gasification-based Power Plant at Gazipur	World Bank	▪ The first of its kind in Bangladesh ▪ Around 300 households and commercial customers have been connected.
50-kW Biogas based Electricity Generation	World Bank	▪ To be implemented.

- Few other RE programmes are in pipeline namely 400-kW Biomass gasification based power plant, Solar microgrid at Sandip, 2 solar irrigation pump, 5-12 MW Solar panel manufacturing/assembling plant.