Abstracts of

National Seminar on Renewable Energy

Focus on Climate Change Mitigation: Role of Renewables

Dhaka, Bangladesh

24-25 March, 2008

Organized by

Renewable Energy Research Centre, University of Dhaka

Bangladesh Solar Energy Society

Day one 24.03.08

11:00-12:00

Key note

Chair: Prof. M Hussain

Co-Chair: Prof. S K Aditya

1. The role of IPCC in mitigating Climate Change in Bangladesh- Dr. Atique, BCAS, Bangladesh

2. Achievement of IDCOL in Promoting Renewable Energy Technology in Bangladesh- M. Ehsanul Haque, Infrastructure Development Company Limited, Bangladesh

3. Role of Private Enterprises in Commercializing RET-
Munwar Misbah Moen, Rahimafrooz Renewable Energy Limited, Bangladesh

12:00-1:00

Contributory paper

1. Electric power generation from rice husk-Khursheed-Ul-Islam and Shahidul I. Khan

2. The Potential of Electricity Generation from Poultry Droppings in Bangladesh- Sheikh Ashraf Uz Zaman & M. A. Rashid Sarkar

3. Roof Top Grid-Connected Solar Photovoltaic System For Renewable Energy Research Center of University of Dhaka, Bangladesh, S Huque, R. K. Mazumder, S K Adittya, and M.H Rahman

4. Statistical Analysis of Wind Data at Engineering Staff College, Meghnaghat-Arafat A. Bhuiyan, A K M Sadrul Islam and M Murtaza Ali

5. As-LEACH: an advanced solar aware protocol for energy efficient routing wireless sensor networks- Md. Muhidul Islam Khan, Dr.Shahida Rafique

6. Contribution of LGED to disseminate RETs in Bangladesh- Mir Tanweer Husain, Sustainable Rural Energy, Local Government Engineering Department

2:30-5:00

Contributory paper

Chair: Prof. S Rafique

Co-Chair: Prof. Saiful Haque

1. Study the Climate Change over Bangladesh- I. A. Keka, M.M. Rahman and I. Matin

2. A Concept Note on Biogas : Lesson Learned by Bangladesh Association of Social Advancement (BASA)- Quazi Alamgir Kabir
3. Applicability of ITO for achieving highly efficient solar cell- Dilshad Mahjabeen, Zahid Hasan Mahmood,Shahida Rafique
4. Earth Air Tunnel and Cavity Wall as Passive Cooling For Energy Conservation in a Garment Factory of Bangladesh- Saiful Huque, Sajedul Hossain Sarker and Shahadat Musharraf Khan
5. Development of a pollution free solar drier for tomato- M. A. Hossain and M. Arshadul Hoque
6. Renewable Energy : Biomass- Nuran Nahar Begum
7. Role of Green Plants in Climate Change Mitigation- A.K.M. Nazrul-Islam, A. Emdadul Hoque and Ahmed Sayeed Nazrul
8. Activities of Coromarent in sunshine- Nurjahan Sarkar

Day two 25.03.08

10:00-11:00

Key note

Chair: Prof. R K Mazumder

Co-Chair: Prof. Saiful Haque

1. CMES experience of the rural home electrification through Solar PV within a microcredit arrangement-Muhammad Ibrahim, Centre for Mass Education in Science, Bangladesh

2. Energy Sector Development Strategies in the Context of Climate Change to face the Challenges of the Sustainable Development of Bangladesh-Mohammad Shawkat Akbar, Bangladesh Atomic Energy Commission, Dhaka-1207, Bangladesh

3. Global Climate Change: The Role of Universities- Shahdia Rafique, Department of Applied Physics, Electronics and Communication Engineering, University of Dhaka, Bangladesh

4. Participation of rural women in RET- Hosne Ara Begum, TMSS

11:00-1:00

Contributory paper

1. Technology, People's Participation and Future Challenges: in the lance of Climate Change- Md. A. Halim Miah,
2. A greenhouse thermal modeling- Md. Sakhawat Hussain
3. Climate Change Mitigation : Role of Renewable Energy- Md.Golam Mowla Choudhury
4. Self – Similar Nature of Solar Radiation: Modeling and Estimation- Runa Rokshana Khan, Md. Muhidul Islam Khan, M. Ismail Jabiullah and Shahida Rafuque
5. A software for efficiency calculation for a two phase thermo-syphon type solar water heater- Masud Zaman
6. A solar-aware wireless sensor network based on low energy adaptive clustering hierarchy- Ajmery Sultana and Shahida Rafique
7. Mitigating grid energy related GHG emissions through solar energy- H R Ghosh, N C Bhowmik and J Rahman
8. Modeling a Drip Irrigation system powered by renewable energy source- H RGhosh, N C Bhowmik, J Rahman and M Hussain
9. Daily global radiation tilt factor for Dhaka- H.R Ghosh, S K Khadem, N C Bhowmik and M Hussain
10. Determination of the long-term trend of Green House Gas emissions from energy sector of Bangladesh- Farid Hossen Khan, A.B. M. Obaidul Islam and S. Akbar

Keynote Papers

Achievement of IDCOL in Promoting Renewable Energy Technology in Bangladesh

M. Ehsanul Haque
Infrastructure Development Company Limited, Bangladesh

IDCOL has been playing pioneering role in promoting Renewable Energy in Bangladesh. Until now, IDCOL has successfully promoted several Renewable Energy Technologies in Bangladesh namely Solar, Biogas and Biomass gasification based power plant. Recognizing the role of Renewable energy in the context of increasingly depleted existing conventional energy sources, IDCOL is looking forward to promote and implement many other potential renewable energy technologies i.e., Biogas based Electricity Generation (up to 500 kW), Electricity Generation from Urban Waste, Bio-fuel Production and etc.

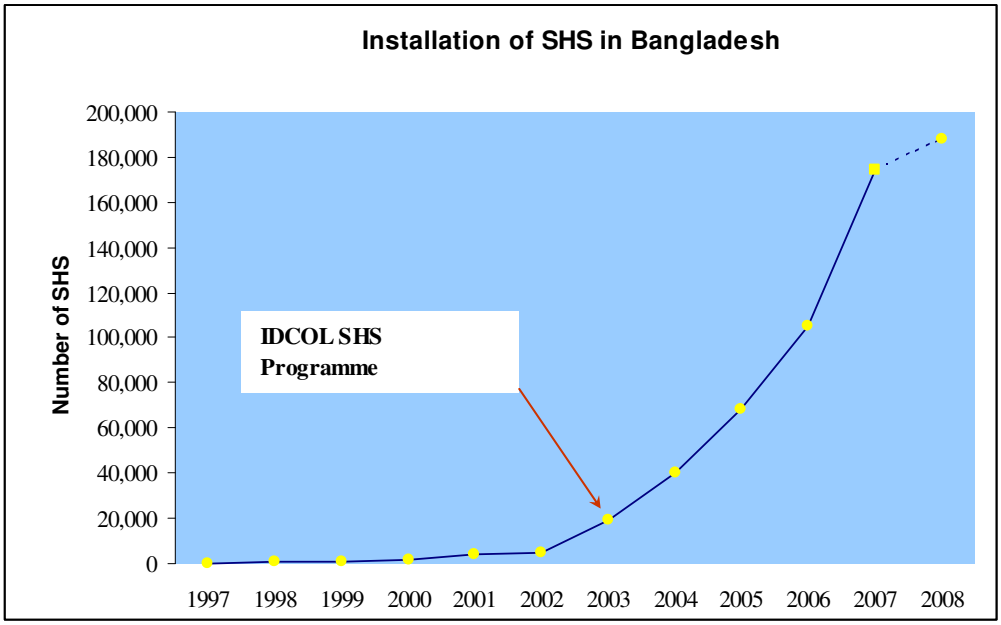
The IDCOL's Solar Programme has the mission of fulfilling basic electricity requirements in the rural areas of Bangladesh and hence, supplementing the government's vision of electrifying the whole of Bangladesh by the year 2020. IDCOL, with support from IDA and Global Environmental Facility (GEF), KfW, GTZ, is channeling both grant and refinancing to renewable energy projects in rural areas under this programme. IDCOL currently promotes SHSs in the remote rural areas of Bangladesh through its 16 partner organizations (POs).

SHSs are sold (mostly through micro-credit) by POs to the households and business entities in the remote rural areas of Bangladesh. IDCOL provides refinancing facility to the POs and channels grants to reduce the SHSs costs as well as support the institutional development of the POs. In addition, IDCOL also provides technical, logistics, promotional and training assistance to the POs.

Started in January 2003, IDCOL's initial target was to finance 50,000 SHSs with financial assistance from the World Bank and GEF by the end of June 2008. The target was achieved in September 2005, 3 years ahead of schedule and US $ 2.0 million below estimated project cost. IDCOL now has a revised target of financing 228,000 SHSs by 2009 with additional assistance from the World Bank, KfW, GTZ and Government of Bangladesh (GOB).

Up to February 2008, about 180,000 solar home systems have been installed in remote rural areas under IDCOL solar program.

IDCOL's Solar Energy Programme is one of the fastest growing renewable energy programs in the world. The following figure shows the expansion of usage of solar home system in Bangladesh before and after the IDCOL Solar Programme.



SHS is a convenient mode of supplying power for small electrical loads such as lights, radio/cassette players and black and white TV. Although available for limited number of hours in a day the supply is reliable and the system can be managed with a little training. A SHS system includes PV module, battery, charge controller, solar lamp and switch. Except for the PV module, other components are produced locally. IDCOL is also trying to establish a 1-2 MW solar panel assembling plant in Bangladesh through private sector participation to reduce the cost of purchasing PV module.

The programme has also brought in positive changes in the economy of the rural people. Now they are using SHS in the advantage of their income generating activities e.g. working hours have been increased for small businessmen, weavers, tailors, hair dressers, and handicraft makers. Students are also getting benefits through extended hour of studies at night. In addition, the use of TV and radio has enhanced rural people's access to the outer world. Many women opined that they were feeling more secured at night after installation of SHS.

A good number of job opportunities, both for skilled and unskilled manpower, have been created. Charge controller and solar lamp manufacturers provide poor women with a job opportunity. Specially, each unit office hires a local youth who has good knowledge about the area. It has paved the way for creating job opportunity locally. In addition, a good number of diploma engineers have been employed by POs to look after the technical aspects of SHS. Till January 2008, some 5000 new jobs have been created by the program.

With support from SNV, Netherlands Development Organization and KfW, Germany, IDCOL has undertaken a project called National Domestic Biogas and Manure program (NDBMP). Under this program, 60,000 domestic size biogas plants have been planned to be

installed in Bangladesh by the year 2010. Gas produced from these plants is being used for cooking purposes in rural households and this is expected to have a positive impact on the environment by preventing deforestation and improving soil fertility. In addition, the slurry, by-product of biogas plants, being a very good organic fertilizer can also be used to improve soil fertility

IDCOL is implementing the program through its 20 (twenty-one) construction partner organizations (CPOs), manufacturing partner organizations (MPOs), lending partner organizations (LPOs).

A total of 4,823 (Four thousand eight hundred twenty three) plants have been awarded pre-approval of which 3,186 (Three thousand one hundred and eighty six) have been completed in several districts of the country.

IDCOL provides Tk. 7,000 as investment subsidy to each household for installing biogas plants as per the specifications and standards set by IDCOL / SNV.

IDCOL financed a 250 kW biomass gasification based Power Plant, the first of its kind in Bangladesh, at Kapasia of Gazipur district. Dreams Power Private Ltd. (DPPL) a local sponsor has developed this project. IDCOL provided concessionary loans and grants, sourced from IDA and Global Environmental Facility to this project. The plant uses locally available agricultural residues i.e. rice husk as fuel for power generation. The project started commercial operation in October 2007. IDCOL envisage installing 10 more such plants in 2008 and 20 in 2009.

CMES experience of the rural home electrification through Solar PV within a microcredit arrangement

Muhammad Ibrahim

Centre for Mass Education in ScienceBangladesh

Centre for Mass Education in Science (CMES) took up Solar PV rural home electrification efforts through microcredit over the last few years. A total of 1689 home systems have been installed in the villages of districts Dinajpur, Rangpur, Lalmonirhat, Chapai-Nowabgonj, Rajshahi, Sirajgonj, Tangail, Gazipur, Patuakhali, Borguna, and Jhalokathi. Of these 60% Systems are 50 p Watt while 32% are 40 p Watt. The rest are 30 pW (4%) and 65 pW (2%). The majority of the customers are relatively well to do businessmen or service people, many of the latter working abroad. Though some interest have been shown by relatively poorer sections of the villagers, and some of them bought the 30 PW systems, their proportion is not very significant.

The 65 pW and 50 pW systems usually used a black & white TV along with lights and a mobile phone charging point. Of these the larger systems used 5 and the smaller systems used 3 or 4 10W fluorescent tubes. 40 pW systems concentrated only on 3 lights with the mobile charging point, while 30 pW systems with only 2 lights. Lights made up as a combination of LEDs have been experimentally tried, but practical difficulties and costs prevented their regular introduction.

The economic package has been that of a microcredit involving a down payment (20% of the system cost) and a monthly instalment that includes a 10% service charge. Though different rates of instalments are offered for a 1,2 or 3-year credit, most of the customers preferred a 3-year one. A typical 3-year arrangement for 50 pW systems involves a down payment of Tk. 5,900, and a monthly instalment of Tk 853. The recovery rate is around 80%, low compared to the 99% for the regular microcredit that CMES provides to the local youth from the poor families for their income generation works. The greatest challenge is to make the overdue recovery. The sparse density of the systems combined with the delay in repairs for logistic reasons, and a less than enthusiastic willingness to pay, makes the challenge quite formidable.

The main reason given by the customers for non-repayment is occasional failures of power. Our studies have shown that in most cases the failure originates in unauthorized uses by-passing the charge controllers. There are however some genuine maintenance problems. Battery failures are taken care of by the manufacturers under a 5-year guarantee. As CMES fabricates the balance of system – charge controller and electronic ballasts, it can repair these either in situ or in its local laboratories.

Apart from the low recovery, the major problems faced are increasing system costs, sparse density of installations forcing a higher overhead costs (personnel, transport, office etc.), and difficult procurement of panels and accessories. In the absence of a reasonable local supplier, the panels have to be imported through the formation of a consortium of several servers. The uncertainty of the supply of panels has been the biggest impediment in the rapid extension of the program, so far.

CMES's main strategy in overcoming these barriers has been the maximum degree of decentralization. It has trained local young people to install, manage, and maintain the systems as well as running the microcredit arrangement and motivating the potential customers. Other local youths get involved in locally manufacturing the balance of the system.

Role of Private Enterprises in Commercializing RET

Munwar Misbah Moen

Rahimafrooz Renewable Energy Limited, Bangladesh

As we know, renewable Energy is from an energy source that is replaced rapidly by the natural process as it is available in the nature. It could be sustainable with concerted effort from Government, Private Enterprises and other Development Agencies.

The Private Enterprises has been playing vital role in the RET field as

- Technology provider & system designer
- System Integrator
- Component provider

Status of Renewable Energy in Bangladesh:

1. Solar home system (IDCOL Program) : 1,80,000 units (9 MW)
2. Other solar projects: 200kWp
3. Improved biomass cooker: 3,00,000 Units
4. Biogas plants: 25,000 Units

5. Biomass briquette machines: 100 Units
6. Wind turbines: 2.8MW

Contribution of Private Enterprises to Renewable Energy Sector:

- Inputs in developing & improving the Policy
- Market Development by creating awareness
- Capacity Building
- Customized solutions
- Service Facilities

Future role of Private Enterprises to Renewable Energy Sector:

- Development & improvement of Technology designs
- Innovative solutions to both Rural & urban sectors
- Creating more awareness
- Spreading knowledge through training & development
- Enhance manufacturing and service facilities
- Scale up implementation of RET

Role of Private Financial Institutions

- Private Financial Institutions with could extend soft loan facilities to the end-users of RET
- Micro Financial Institution could provide loan to end-users of RET

Role of Corporate Houses:

Incorporate & implement Renewable Energy Applications wherever possible for sustainability in respect of environment & long term return.

Global climate change mitigation: the role of academic institutions

Shahdia Rafique

Department of Applied Physics, Electronics and Communication Engineering University of Dhaka

INTRODUCTION:

Climate change means change in the long-term meteorological. A change from one climate mode to another which is outside the range of natural climate variability creates climate change. It has been seen that climate change is associated with changes in the natural forces that control climate such as earth-orbital parameters which effects in the solar radiation and temperature circulation. Recently the significant increase in the concentration of GHGs has been observed which can be related to increase use of fossil fuels. Increased GHG has the potential to change this space time patterns of global climate. It has been found that GHG have continued to accumulate in the atmospheres due to the emission of gases arising of human activities causing global worming that could threaten the life support system in the planet.Potential impacts of Global climate change on the natural environment, human life,

health, socioeconomic activities in various sectors are important attributes to identify and develop technologies & formulate policies to be adopted for sustainable development.

It has been realized that our green planet is highly vulnerable to climate change for various reasons. Adaptation to these changes, for many countries in the world, is one of the environmental challenges to be face by the planet for survival.

Anticipatory actions are to be taken to mitigate this climate change effects and remedial actions to be taken urgent urgently. Climate change scenario integrated in socio-economic, education, research and development process putting the issue in the highest order. For this climate change scenario is to be designed to identify sectoral sensitivity to climate change and also to predict future climate.

ROLE OF THE ACADEMIC INSTITUTIONS:

"It is the cause that produces effect, the effect cannot come by itself. The realization of the idea is the effect. The means are the cause, attention to the means, therefore is the great secret of life"—Swami Bibekando.

The moral of that above couatation can be realized that for that education in general and the renewable energy education in particular, is the selection of the right means for the mitigation of the global climate change. The roll of the academic institution is obvious – energy education training design and development of RET production of energy with environmental social and economical considerations etc. The role of the academic institution go that local and global level is essential and vital attribute for calculating the link budget of the life cycle of all living being in the planet. It has become imperative to create awareness about the renewable energy resources and utilities by renewable energy education program. The program may include-

1. Introduction and elementary courses of renewable energy at primary and secondary level.
2. Introduction of full subjects at graduate, post graduate and higher level in degree colleges, institutions and universities.
3. Launching to any program for mechanics, technicians, scientists and engineers to implement RET at various levels.
4. Providing sufficient financial support for renewable energy research including industries oriented research for production and exploration.
5. Establishment of R & D centers for fabricating sophisticated renewable energy resources.
6. Launching a people oriented renewable energy education programs for folk dance, drama etc.

At the elementary level I would like to start with the famous slogan "catch them young" this can be applied for energy education among the kids. Startup can be basic queries like "What", "Why", "Who", "When", "If not then what" etc. To answer this that could be appropriate approach for young kids.

Step-1: Energy, the basic definition, sun as a source of energy etc and some practical demo like “Fun with the sun”, “our wonderful sun” etc. As for example, energy is the ability to do work. It lights our room, powers our vehicles, trains, rockets, it cooks our food, plays or music, give picture on music etc. Sun gives us light everyday dries our cloths, it helps plants to grow. Energy stored in plants is eaten by animals, animals eat their prey. So everything we do is connected to energy in form or another.

Step-2: It may consists the different form of energy such as electricity, biomass energy from plants, geothermal energy, fossil fuels, coal, oil and natural gas, hydro power and oceanic energy, wind energy, solar energy, then these are answers of energy-What is it?

Step-3: It may consists “Where the energy coming from?” Say for example, coming from sun. Sun is star. Heat energy, solar hot water, solar thermal, solar electricity, solar cells or photovoltaic energy.

Step-4: Methods of energy generation, renewable energy, hydro power, hydro damn, geothermal technique and finally nuclear energy E= mc

METHODOLOGIES TO ASSES CLIMATE CHANGE

Some basic methodologies may be adopted for creating climate change scenario. These are (a) adapting general circulation model (GCM), (b) incremental method, (c) analog method, etc. The GCM is a mathematical method that represents the changes in the atmosphere, ocean and land profiles. GCM can represent the present climate (1 x CO_2) and the increased in CO_2 content in mathematical order such as 2 x CO_2, 3 x CO_2, etc. Output of the GCM at various locations in Northern and Southern hemisphere can be analyzed and compared with the long term statistical data to asses the climate change scenario.

	Air pollution	Climate change	Land use and degradation	Water use and quality	Wildlife	Radiation
Coal	Very high: PM, NO Moderate: hazardous metal(e.g. mercury) and organic air pollutants	Very high	High	High use Moderate Low use	High: Air pollution Potentially high: climate change	Low

Oil	High Moderate	High	Moderate	Moderate use: steam plants potentially high	Moderate potentially high	Near zero
Natural gas	Very low and high	Moderate high low	Low to moderate	Low in combined cycle ;near zero in simple cycle	Low potentially high	Near zero
Biomass	Low to moderate Near zero	Very low potentially high	Low or near zero potentially moderate benefit	High use potentially moderate	Potentially high Low to moderate	Near zero
Wind	Near zero	Very low	High	Near zero	Near zero	Near zero
Photovoltaic	Near zero	low	Very high	Near zero	Near zero	Near zero
Geothermal	Near zero to very low	Very low to low	very low	Near zero	Near zero	Near zero
Hydroelectric	Near zero	Potentially very high	High	High Low	Very high Less harmful	Near zero
Nuclear	Near zero	Very low	Very low	High	High	Moderate to high potentially very high

Incremental method consists of incremental changes to meteorological variables such as radiation, temperature, humidity, rainfall, etc. to construct climate change scenario. Incremental changes can be compared with the long term observed climate data to realize the change.

Analog method includes historical warm/cold periods to compute climate change. Anthropogenic activities, the natural phenomenon like tropical cyclones; tidal waves could be related to climate change behavior. Land-loss profile, coastal erosion, coral reefs, etc. can be considered to draw the model.

Direct effect of elevated CO_2 and other GHG on agricultural products is another parameters to asses climate change. Changes in climate parameters such as temperature change, radiation dose, amount of rainfall, variation of humidity, etc. on crop production that have direct effect on human life cycle socio-economic, food and employment in the society are to be integrated to get a clear picture of climate change. Finally, the effect of climate change regionally and globally is the basis to predict the global climate change.

To mitigate this problem, there exists hundreds of solutions, "Decade-by-Decade approach" to global climate change is practiced all over the world which includes global worming. The greater challenge facing our planet's viability is the global worming. Long-term and immediate policies are used to confront these problems. Low carbon economy is another consideration.

OBSERVATION OF CLIMATE CHANGE

Available instrumental observational records show that (i) global mean temperature has increased between 0.3 ~ 6^0C since 19^{th} century. Global mean sea level has risen between 10~ 25 cm over the same time. (ii) Night time minimum temperature on earth surface has increased more than the day time temperature on land. (iii) The atmospheric environment is getting warmer and the warmest record is on 1998 which may cause the upcoming of La Lino condition. It has been found that variability of meteorological and hydrological factors in global and local scales influence energy production, demand and supply scenario and operation of energy systems. Again meteorological and hydrological conditions have both direct and indirect impacts on renewable energies. However, Kyoto protocol has been developed which requires the developed countries to reduce the emission of six major GHGs by at least 5% below 1990 level between 2008 and 2012.

Energy Education in School Level:

MODULE I: *INTRODUCTION TO ENERGY*

Submodule A:Energy Sources and Supplies

Topics:

A. Forms of Energy

B. Energy Conversion

C. Types of Resources and Projected Availability

D. Energy Crises

Submodule B: Energy Use

Topics:

A. How Energy is Used

B. Energy use Sectors

MODULE 11: *EXPLORING ENERGY TECHNOLOGIES*

Submodule A: Solar Energy

Topics:

A. The Nature of Solar Energy

B. Solar Heating and Cooling

C. Photovoltaics

D. Social Issues, Economic/Environmental Impacts, and Future Projections

E. Career Information

Submodule B: Other Renewable Energies

Topics:

A. Wind Energy

B. Water Power

C. Bioconversion Energy

D. Ocean Energy Resources

E. Social Issues, Economic/Environmental Impacts, and Future Projections

F. Career Information

Submodule C: Fossil Fuels

Topics:

A. Petroleum and Natural Gas

B. Coal

C. Storage and Distribution of Fossil Fuels

D. Social Issues, Economic/Environmental Impacts, and Future Projections

E. Career Information

High school level:

Submodule D: Nuclear Fission

Topics:

A. Development

B. Atomic Theory

C. Uranium Mining, Fuel Processing and Fabrication

D. Reactor Types

E. Safety

F.Waste Disposals Spent Fuel Storage and Reprocessing

G. Social Issues, Economic/Environmental Impacts, and Future Projections

H.Career Information

Submodule E: Nuclear Fusion

Topics:

A. Nuclear Fusion Theory

B. Containment Designs

C. Social Issues, Economic/Environmental Impacts, and Future Projections

D. Career Information

Submodule F: Geothermal Energy

Topics:

A. Geothermal Energy Development

B. Geothermal Reservoirs

C. Extraction Techniques

D. Conversion Technologies

E. Social Issues, Economic/Environmental Impacts, and Future Projections

F. Career Information

MODULE III: *TYPES OF ENERGY CONVERSION SYSTEMS*

Topics:

A. 1st and 2nd Laws of Thermodynamics

B. Fuel Conversion

C. Generation of Electricity

D. Other Methods of Producing Electricity

MODULE IV: *ENERGY CONSERVATION*

Topics:

A. Definition, Terms, and Importance

B. Energy Conscious Design

C. Residential, Commercial, Industrial, and Transportation

D. Personal Commitment

University Level:

Photovoltaic (PV) system design including systems with and without energy storage, systems with and without inverters, stand-alone and grid-connected systems. Discussions will include hybrid systems.

Mathematical models of building envelope and comfort conditioning systems as basis for optimization techniques

High Efficiency Appliances,PV: for computers and communications, Lighting, Fans & Coolers, Water Pumping, Backup & emergency Power; Line-Tie systems, Whole Home Power, Government assistance.

Fundamental concepts of energy and radiation with specific solar energy applications; design of integrated solar energy systems. Solar geometry, photovoltaics, pyrometers and pyroheliometers, wind turbine, electrical energy storage systems, solar radiation, thermal energy and storage, economics and comparative futures of solar systems.

Thermo dynamics & Aero dynamics.

Energy Efficient Buildings and Design

THE ROLE UNIVERSITIES:

University may describe itself as an institution dedicated to education, research, development and policy formulation to the global climate change. It has been realize that reduction of GHG emission to minimize global warming requires minimizing the use of fossil fuels. To

achieve the use of renewable energy technology (RET) is to be practiced all over the globe for production of electrical and thermal energy. To launch the project on the renewable energy, precise and adequate information on the resources are to be assessed. University can play a role model in this field by giving education, training, and creating research facilities with adequate infrastructure to the younger generations. It is to be assured that natural resources contribute to sustainable development in the topics for environmental protection.

University could be a novel educational model by introducing a refreshing a modern way of instructions emphasizing in a pollution-free environment.

University could launch international feasibility to be conducted with International collaboration. The goal of the university should be to set an equal emphasis on the entrepreneurial skills, commitment to the society and responsibility to the global environment. The task of the university should aim to teach students to create jobs rather than to seek jobs.

The university should give equal opportunities to the young generation both men and women that come from lowest economic ladder and provide them with better education.

The university may create an environmental team for design development in RET education and integrate them in the main education system.

The university may formulate RE policy. The key elements of the policy may include object oriented, subject-oriented and connection-oriented education training information exchange. This is essential for policy implementation. The policy may also include searching potential leaders, investors, and end-users for the benefits of renewable. The state of the art technology may be the probable and available support for the policy.

The university can launch industry oriented research and develop international standard and regulations. This will prevent environment pollution creating hardware from entering the market locally and globally. This will also encourage and foreign investors for creating confidence in users to explore RET materials. The university can formulate policy which is sustainable and consistent in order to avoid “boo and burst” cycles that shake the industries and the country as a whole.

The university may can integrate public participation and ownership in the RET developmental process. This will increase public and political support which is the main key of the success.

This is the way the university can play the role to mitigate global climate change – to lead to change the world.

The ultimate aim and objective is to step forward to a transition to a cleaner energy system.

Energy Sector Development Strategies in the Context of Climate Change to face the Challenges of the Sustainable Development of Bangladesh

Mohammad Shawkat Akbar

Bangladesh Atomic Energy Commission

E-12/A, Agargoan, Shere-Bangla Nagar, Dhaka-1207, Bangladesh

ABSTRACT

Energy is an essential input for social development and economic growth, providing basic needs and services and a critical production factor in virtually all sectors of the economy. On the other hand, production and utilization of energy cause environmental degradation at the local, regional and global levels. Thus, there is a need to provide adequate energy services at affordable costs, in a secure and environmentally benign manner and in conformity with a country's social and economic developmental needs. At present the gap between supply and demand of energy in Bangladesh is increasing and hampering the industrial production and improvement the quality of life. A sustainable and balanced energy supply in the long-term basis is essential. The energy planning in Bangladesh is a big problem if the target is to ensure sustainable development. This challenge has turned complex due to certain features typical of the socioeconomic state of Bangladesh which includes limited accessibility and affordability of energy services, the lack of energy supply security, resource scarcity, etc.

In recognition of the importance of energy in socioeconomic development of the country, the Government of Bangladesh (GOB) has been giving continuing attention to the overall development of energy sector since her independence. Presently, the Government of Bangladesh (GOB) is committed to halving its poverty level by 2015. In recognition of the importance of energy in poverty reduction and sustainable development, the GOB has been trying to streamline the energy and power sector through a series of policy and institutional reforms and measures and sets a time-bound goal for narrowing the energy access gap: electricity access for all by the year of 2020. Accordingly, Bangladesh Power Development Board (BPDB) has revised the Power System Master Plan of 1995 in 2006 for the time horizon 2005 to 2025 aiming to make electricity available for all at 2020 and to ensure sustainable supply of quality electricity at a reasonable and affordable price. Three projections namely, the Base (5.2% GDP growth and 7.8% Peak demand growth), High Growth (8% GDP growth and 12% Peak demand growth) and Low growth (4.5% GDP growth and 6.7% Peak demand growth) Scenario on electricity demand have been made in the revised PSMP. According to the Base and High Growth Scenario the generation will be 51,000 GWh and 69,000 GWh respectively in 2015, which is more than double the present generation rate (about 25,000 GWh)). By this time, 23 and 16 Projects are planned for implementation mainly based on indigenous gas and indigenous as well as imported coal respectively. In 2015, the installed capacity will be 12,000 MW and 16,000 MW according to the Base and High Scenarios respectively. This means that at least 8000 - 11,000 MW new installed capacity needs to be added by 2015 to meet the required demand 10,000 – 13,000

MW as projected in Base and High Scenarios. Up to now, only 5 to 6 projects are identified. About 10.0 TCF of gas would be needed for the plants installed up to 2015 for their whole life according the to Base case, however, the picture would be rather different for High scenario.

The National Energy Policy (NEP) of 1996 is updated in 2007 aiming to provide adequate and secure energy supply to all end-users to support sustainable economic growth. The separate Power Policy, Petroleum Policy, Hydrocarbon Policy, Coal Policy, Nuclear Energy Policy and Renewable Energy Policy have been incorporated in the updated NEP of 2008. The policy provides specific policy related to issues like development of the energy sector, augmentation of resources, pricing, technological options, fuel and technology mix, conservation, environment, investment, area based planning, bio-mass development rural energy research and development, human resource development, institutional issues and legal issues. The draft NEP of 2007 recognized the diversification of primary energy-mix, identifying development of the five fuels regime namely expanding natural gas supply, developing indigenous coal resources, improving end-use efficiency, extending and efficiently utilizing renewable resources for their thermal and power use and introduction of nuclear for power generation.

Like the original PSMP of 1995, the Revised PSMP was also highly ambitious on indigenous gas and coal. The identified generating options during the projected period 2005 to 2025 are: natural gas fuelled CC of sizes 300 MW, 450 MW and 700 MW, coal and natural gas based ST of sizes 300 MW and 500 MW, natural gas fuelled SCGT and 10 MW diesel fueled plant. The financial viability of a 500 MW PWR was investigated, but was found too expensive. It is not clear why only a 500 MW PWR was investigated, while at the same time 700 MW natural gas fuelled CC is considered. The 700 MW CC is found technically and economically feasible from 2018. Moreover, it was assumed in two scenarios that natural gas is sufficient to fuel only all gas-fueled plants to be installed through 2016. In the third scenario, it is also assumed that 4,000 MW of coal units are to be installed over the period 2012 – 2023 with indigenous coal. This projection was made without making any justification of the availability of indigenous coal and the cost of electricity generation. Moreover, the option of imported coal is not understandable; why it will be an option after the limit of indigenous coal is reached. It is important to keep in mind that in the long-term future the investment cost of coal may be augmented due to environmental issues. A single imported fuel based generation planning is not appropriate for the country in terms of energy security and sustainable development. If energy security issues are well addressed and a nuclear power reactor of medium size (600 MW or above) with per unit (MW) investment cost about 1.5 – 1.8 million USD and efficiency about 85% is considered, the picture would be different.

On the other hand, Bangladesh is committed to the principle of keeping her environment clean. The country is a signatory to Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) and shares the global concern of climate change and ratified the Kyoto protocol. This article covers the current situation of energy development in Bangladesh, government policies and measures to address sustainable development in energy sector, necessities for revising government initiatives and the challenges facing in dealing with climate change.

Thus, formulation of an appropriate long-term power system expansion plan and a realistic energy policy are prerequisites for the energy sector of the country. The successful implementation of the expansion plan and implementation of the policy will help to accelerate economic growth, poverty reduction and sustainable development of the country and to materialize the GOB vision for universal electrification by 2020. In formulating such plan and policy, it is necessary to analyze and identify from the past national experiences the weaknesses, factors and issues that hindered to reach the projected targets of the PSMP of 1995 and the achievement of the goals of the previous energy policy of 1996. In formulating such action plan, the determination of the proportions of indigenous primarily energy supply alternatives as well as imported fuel options has to be made mandatory by identifying and quantifying their share in the long-term horizon. A systematic investigation is required for determination of energy supplies scenarios for different economic growth with due considerations with the limitations of indigenous energy resources, import energy options, the green house gases (GHG) mitigation strategy and the weaknesses and factors of the past plans and policies for formulation of such as action plan. As an effort, some results of preliminary assessment of economic, social and environment indicators; primary energy mix, final energy and electricity supply options, demand side management, technology assessments and policy options such as carbon trade and CDM are also presented.

Contributory papers

A software for efficiency calculation for a two phase thermo-syphon type solar water heater

Masud Zaman
Bakhrabad Gas Systems Limited, Bangladesh
masudzaman@engineer.com

Abstract
A software has been developed for the computation of efficiency calculation for a two phase thermo-syphon type solar water heater at the location 23.7^0 north latitude. For this declination angle (δ), zenith angle (θ), solar insolation, solar constant (S), hour angle (h), ambient temp.(T_{amb}) have been considered. Variations of solar insolation during different times of the day were recorded. It has been also realized that, received solar energy on earth surface is strongly dependent upon temperature variations, humidity, climate change and environmental conditions. Impact of climate change on global radiation is subtle and indirect. A two phase closed thermo-syphon has been designed and fabricated to utilize solar energy for water heating. The working fluid for thermo-syphon was Acetone and Water. For exploiting solar energy for water heating, this thermo-syphon is pretty efficient because, due to phase-change of the working fluid, the effective heat transfer co-efficient is much higher.

A greenhouse thermal modeling

Md. Sakhawat Hussain

Dept. of Physics, University, Dhaka-1000, bangladesh

Abstract:

For heating and cooling a Greenhouse plant is organized and the thermal modeling is achieved in this present paper. Energy balance equation is written for an aquifer coupled caving of those exhumer systems in this following attempt. Walls, roof, doors, windows floor are considered.

Earth Air Tunnel and Cavity Wall as Passive Cooling For Energy Conservation in a Garment Factory of Bangladesh

Saiful Huque[1], Sajedul Hossain Sarker[2] and Shahadat Musharraf Khan[3]
[1,2]Renewable Energy Research Center, University of Dhaka, Dhaka-1000,
[3]Section-7 Ltd. Chittagong E P Z,Halishahar, Chittagong, Bangladesh

Email-saifulhq@citechco.net,qrtzcom@bdcom.com

Abstract

Introduction:

Any building or factory with a large number of occupants in the hot and humid regions can reach high level of thermal stress. Adoption of passive cooling as an alternative to artificial cooling can bring important energy, environmental, financial, operational and qualitative benefits. However, without active cooling passive cooling alone cannot provide the appropriate thermal comfort standard. An addition of active cooling system using air conditioning and refrigeration generate multiple impacts on stratospheric ozone layer, which is primarily linked to release of ozone depleting refrigerants. Release of refrigerants and emission of green house gases (GHGs) make combined contribution to global warming. Very little work has been reported in the thermal performance of building that operates on a mixed cooling system in warm-humid climates. Buildings with such design features are able to balance the need for comfort, eco friendliness and energy efficiency through the year. The economic advantage in terms of energy savings and reduction of GHGs were computed.

Methods:

A dual cooling system was designed and installed in a four-storied garment factory. The cooling system was designed with construction of one hundred Earth Air Tunnel (EAT) under the ground floor in addition to an active cooling system using air cooler. The building geometry was modified to reduce the cooling load by constructing of cavity walls along the sun path facing the building. Programmed active cooling and air circulation mechanism were added to the building to achieve the comfort standard, energy conservation and cost cuts. Supply of fresh air was part of the method too. The thermal performance study of the building system shows that in spite of outside temperature and solar gain during day light hours room temperature remains almost constant throughout. The daylong-operation by the designed system showed that the room temperature range varied from 28°- 29°C while the outside temperature was recorded as 32°-33°C. The room temperature and air circulation is optimized for each floor by changing the air velocity and air volume. The suitability of closed room and open room operation were studied for both summer and winter variables. An objective of lowering energy demand and moderating running cost was also made the targeted goal.

Results:

It was found that the factory saves on an average 500 Mega Watt. hour equivalent of electrical energy and 270 ton of Carbon Emission per year. The temperature and humidity level achieved for indoor comfort were 28-29°C and 65% respectively. The difference of productivity due to indoor comfort level with and without active cooling system was found to be significant.

Conclusion:

The energy crisis situation in the developing country like ours is gradually reaching to an alarming level. Demand for energy is increasing along with the pace of development. Which can also be attributed to a fast growing population. Rapid increase of energy cost has also necessitated the adoption of various mechanisms for an effective and significant saving of conventional energy.

Therefore, the inclusion of active and passive cooling system for a garments factory served both as an energy cost as well as and carbon emission reduction mechanism. A cool comfortable and dust free environment inside the production floors were achieved.

Technology, People's Participation and Future Challenges: in the lance of Climate Change

Md. A. Halim Miah,

Centre for Injury Prevention and Research, Bangladesh (CIPRB)

New DOHS, Mohakhali, Dhaka-1206

Introduction:

There has no society that does not change as changing is an inevitable process of social dynamism. Hence somebody may think so there is no need to take initiative for the progression of the society but knowledge of development does not mean merely a change but many more. These are how progresses are going on it means speed, for whom, how many people are benefited and in what rates, maximum benefit, minimum cost and moreover sustainability. Bangladesh like other developing country is very lack of utilization of advance technologies from per capita perspective. Though it is imperative to increase per capita utilization of technology at least into double from it's the current status of to make the country's faster growth and improving the livelihood of the people but still we are unable to make a pro people national tech- policy.

As-LEACH: an advanced solar aware protocol for energy efficient routing wireless sensor networks

Md. Muhidul Islam Khan[1], Dr.Shahida Rafique[2]

[1] Dept. of CSE, Bangladesh University of Engineering and Technology,

[2]Dept. of Applied Physics, Electronics and Communication Engineering, University of Dhaka

Email: muhit_smart@yahoo.com, shahidarafique@hotmail.com

Abstract

Energy consumption plays a crucial role in Wireless Sensor Networks as these networks are designed to be placed in hostile and non-accessible areas. While battery-driven sensors will run out of battery sooner or later, the use of renewable energy sources such as solar power extends the lifetime of a

sensor network. A solar-aware, clustered routing protocol A-sLEACH is proposed. The simulation shows that this new advanced A-sLEACH has better performance as compared to sLEACH.

Keywords: sLEACH, Cluster Head, CSMA/CA, Wireless Sensor Networks.

Role of Green Plants in Climate Change Mitigation

A.K.M. Nazrul-Islam, A. Emdadul Hoque and Ahmed Sayeed Nazrul*

Ecology Laboratory, Department of Botany, *Department of CSE, University of Dhaka

Abstract

There is no issue at present more challenging or more difficult to solve than the global worming caused by the greenhouse gases, unless it is explosive, exponential growth of the world's human population. The world has been warming over one hundred years and may worm in the future at a rate unprecedented in human existence, as a direct result of industry, forest destruction and agriculture. These activities result in the accumulation of greenhouse gases including carbon dioxide, methane, chlorofluorocarbons, ozone and others. The mitigating measures are difficult scientifically, politically, economically. Hemispheric and global average means air temperatures for land plus marine regions, 1854 – 1990. The regions of the earth's atmosphere with vertical distribution of temperature and ozone are discussed. Cutting and burning forests, burning or plowing grasslands, blackening snow with dust, diverting the flow of rivers, impounding water with dams, building concrete cities and highways and extensive agriculture all these are modifications of the Earth's surface and in turn affect the weather and climate.

The green plants, vegetation and their role were brought to a shaper focus for mitigation measures of climate change. The proper plantation of various kinds of plants in different habitats was highly considered for mitigation measures of the present situation.

Statistical Analysis of Wind Data at Engineering Staff College, Meghnaghat

Arafat A. Bhuiyan[1], A K M Sadrul Islam[1] and M Murtaza Ali[2]
[1]Department of Mechanical & Chemical Engineering, Islamic University of Technology(IUT), Board Bazar, Gazipur-1704, Bangladesh, Tel: +880 2 9291250,Email:sadrul@iut-dhaka.edu
[2] Local Government Engineering Department, Agargaon, Dhaka, Bangladesh

ABSTRACT

Wind characteristics and wind energy potential at Engineering Staff College, Meghnaghat are analyzed taking into account the wind data measured at 10 minutes interval at 20 m, 30 m, and 40 m heights. The wind data used in this study are taken from Local Government Engineering Department (LGED) for 2005-2006.The measured data are processed to calculate monthly and annual wind speeds and power. Weibull Distribution is used to calculate the shape parameter k and scale parameter c. The values for k are found to be 1.84, 2.11 and 2.02 and c to be 3.87, 4.22 and 4.21 m/s at 20m, 30m and 40m respectively. The

monthly mean powers are found as 21.13, 28.70.0 and 35.21 W/m^2 at 20m, 30m and 40m heights respectively.

Development of a pollution free solar drier for tomato

M. A. Hossain* and M. Arshadul Hoque

Machinery Repair and Maintenance Division, Bangladesh Agricultural Research Institute, Gazipur-1701

*Email: mahossain64@yahoo.com

Abstract

A prototype of indirect forced convection solar drier was designed for drying of tomato. The drier consists of flat-plate concentrating collector, a heat storage unit and a drying unit. The drier is a multi stack type with five trays having a loading capacity of 18 kg of fresh half cut tomato. The drier was tested in day time drying using solar radiation and night time drying with ambient air and with heated air by hot water flow from the storage tank .Day time average temperature augmentation at the outlet air of the collector was about 30°C over ambient air temperature and collector efficiency varied from 25 to 60%. By hot water circulating in the collector, drying air temperature was about 15°C higher than the ambient air. Solar drier system efficiency was found to be 17.92 and 22.48% for drying mode 1 and mode, respectively. Carbon monoxide emission was calculated for energy required to dry 18 kg of tomato using conventional fuels. Energy used in solar drier was completely carbon monoxide free and did not pollute the environment.

Renewable Energy : Biomass

Nuran Nahar Begum

Institute of Fuel Research Development,

BCSIR, Dhaka

Introduction

In the last few years there has been a wide spread fear that the world resources would dry up if the growth remains unrestricted. This was justified from the ecological point of view about the conservation of organic environment. A national research council study date May, 2001 stated “Green house gases are accumulating in earth atmosphere as a result of human activities, causing surface air temperatures and subsurface ocean temperatures to rise. Temperature is in fact rising. The changes observed over the last several decades are likely mostly due to human activities, but can not rule out that some significant part of these changes is also a reference of natural variability. Green house gas emissions like CO_2, methane, nitrous-oxide etc. come mostly from energy use. Pollution free and greater efficiency of energy use are necessary to meet the basic needs of a growing population. It will therefore be necessary to tap different resources of renewable energy which are available considering economic, technical viability and keeping in view of the environment quality.

More than 56.38 million tonnes of biomass fuels are being consumed annually for cooking, parboiling, concentrating date palm sugar cane juice etc. The stoves used for these purposes are very inefficient, efficiencies varying from 5-15% and these causing an unnecessary wastage of biomass. The inefficient traditional stoves produce GHG which are harmful to the health as well as to the environment.

With the increase of population the use of traditional fuel like wood, twigs, straw etc. also increases. This is causing rapid deforestation and consequently a change in the ecosystem leading to erosion of soil and changes in the climatic pattern. Increasing of GHG in the environment due to increased burning of biomass and other fuels is leading to environmental degradation.

To overcome the above mentioned problems, Institute of Fuel Research & Development (IFRD) of Bangladesh Council of Scientific and Industrial Research (BCSIR) has developed a series of improved stoves. The advantages of these stoves are -

i) Save 50-65% fuel in compares on with traditional stoves;
ii) Save about 40% cooking time in comparison with the traditional stoves (in case of double mouth stove with chimney);
iii) Keep the kitchen environment clean as the chimney takes away the flue gases out of the kitchen;
iv) Maintain a sound health;
v) Enhancing forestation and agricultural production;
vi) Reduce the GHG emission in the atmosphere.

In this paper, development and promotion of improved stoves for conservation of our biomass and reduction of GHG have discussed.

Roof Top Grid-Connected Solar Photovoltaic System For Renewable Energy Research Center of University of Dhaka, Bangladesh

S Huque, R. K. Mazumder, S K Adittya, **and** M.H Rahman

Department of Applied Physics, Electronics and Communication Engineering, University of Dhaka, Dhaka-1000, Bangladesh, email saifulhq@citechco.net

Abstract

1. Introduction

Bangladesh is an energy deficit country and its fuel import bill occupies a significant portion of the total amount of export earnings. Load-shedding and suspension of production of electric power is a daily occurrence. Access to electricity in Bangladesh is one of the lowest in the world. Around 30 per cent of the total population has electricity coverage. However, in the rural areas where nearly 80 per cent of the total population lives, only have about 10% coverage. Solar home systems are now gradually becoming popular in Bangladesh and have good dimension. Grid-connected PV-system can be good power sources in cities and in remote areas where power generation in the existing grid is needed to be increased. With a view to study the applicability as a power system in Bangladesh and to adapt the technology, the first ever roof-top PV system (financed by the Ministry of Science and Information and

Communication Technology) has been successfully installed in Bangladesh at the roof-top of Renewable Energy Research Centre (RERC), Dhaka University (DU) and is ready for practical demonstration and performance study to run successfully in Bangladeshi environment. A preliminary economic analysis of the above grid-connected PV system along with various other sizes has been done and the results were compared to study the viability of the system.

Applicability of ITO for achieving highly efficient solar cell

Dilshad Mahjabeen, Zahid Hasan Mahmood,Shahida Rafique

Dept. of Applied Physics, Electronics and Communication Engineering

University of Dhaka

Abstract

Typical thin film device uses a thin layer of a transparent oxide –TCO such as tin oxide because these oxides are highly transparent and have a good electrical conductive. By adding, a separate antireflection coating may enhance the conductivity in case of semitransparent conducting device. The power output of a solar cell is considerably affected by transmittance, reflectance and even by a slight increase in resistance. Developing a high quality transparent back contact, while maintaining efficient light transmission through the top absorber layer, are the key components for achieving high efficiency solar cells. Recent studies show that transparent indium tin oxide-ITO is an excellent candidate to use as TCO for highly efficient solar cell. ITO thin film with thickness of almost 0.6μm is developed by thermal evaporation, which is appropriate to provide antireflection coating properly. The optical properties like transmittance, absorptence, reflectance spectra and refractive index of ITO thin film are obtained. In ITO approximately 90% of optical transmission is available which is better than any other TCO (like FTO: 80%, IZO-85%, CeO_2 70%). Since the coating has a refractive index of around 1.65 approximately and provides good adhesion with Si, it can be additionally used as antireflection coating by suitably selecting the thickness. As a consequence, theoretical calculation has been done with ITO nano structure. It has been realized that ITO nano layer (thickness of 0.65μm) can improve the efficiency of solar cell 4-5%. Further work is in progress. It is suggested that antireflection coating with indium tin oxide- ITO is the provable candidate for design and development of an efficient solar cell.

A Concept Note on Biogas : Lesson Learned by Bangladesh Association of Social Advancement (BASA)

Quazi Alamgir Kabir

What is biogas?

Biogas typically refers to a gas produced by the biological breakdown of organic matter in absencia of oxygen. Biogas originates from biogenic material and is a type of biofuel. One type of biogas is produced by anaerobic digestion or fermentation of biodegradable materials such as biomass, manure or sewage, municipal waste, and energy crops. This type of biogas is comprised primarily of methane and carbon dioxide.

The other principle type of biogas is wood gas which is created by gasification of wood or other biomass. This type of biogas is comprised primarily of nitrogen, hydrogen, and carbon monoxide, with trace amounts of methane.

When produced , this gas is a combustible mixture of gaseous materials formulated by micro-organisms when livestock manure and other biological wastes are allowed to ferment in the absence of air in closed containers. The major constituents of biogas are methane (CH_4, 60 percent or more by volume) and carbon dioxide (CO_2, about 35 percent); but small amounts of water vapour, hydrogen sulphide (H_2S), carbon monoxide (CO), and nitrogen (N_2) are also present. The composition of biogas varies according to the biological material. The methane content of biogas produced from night soil (human excreta), chicken manure and wastewater from slaughterhouse sometimes could reach 70 percent or more, while that from stalk and straw of crops is about 55 percent. The concentration of H_2S in biogas produced from chicken manure and molasses could be as high as 4 000mg/m^3, and from alcohol wastewater even higher at 10 000 mg/m^3. Biogas is mainly used as fuel, like natural gas, while the digested mixture of liquids and solids 'bio-slurry' and 'bio-sludge' are mainly used as organic fertilizer for crops. But there are numerous other uses for biogas, bio-slurry and bio-sludge.

A solar-aware wireless sensor network based on low energy adaptive clustering hierarchy

Ajmery Sultana and Shahida Rafique

Applied physics, Electronics and communication engineering**,** University of Dhaka

Abstract

A routing protocol algorithm, "Solar-aware LEACH" has been designed and implemented for wireless sensor network. The protocol is based on low energy adaptive clustering hierarchy and the module is solar powered. To design the model a "100-node" wireless sensor network has been considered where sensor nodes are randomly distributed. The topology of this model has been specified using omnet++, a discrete event simulator. In building the simulation model the parameters that have considered are no. of nodes, transmission range, 2-D area, solar round, solar frame, sun-duration, sun-node etc. These parameters have been assigned to the model and outputs have been obtained. Solar powered sun-node, sun-duration etc, have been verified and validated through experimentation. It has been found that for longer sun-duration the energy dissipation per node with respect to time decreases and the number of rounds (until the first node dies) increases with increased sun-nodes. Eventually the network

lifetime increases. So it is realized that "solar-aware LEACH" significantly extends the lifetime of wireless sensor network. Thus it is suggested that an energy efficient wireless sensor network can be designed using "solar-aware LEACH" routing protocol, that indicates the probable use of solar energy in communication engineering.

Study the Climate Change over Bangladesh

I. A. Keka[1], M.M. Rahman[2] and I. Matin[3]

[1,2]Department of Physics, University of Rajshahi, Rajshahi-6205, Bangladesh

[3]Department of Civil Engineering, Rajshahi University of Engineering & Technology,

E-mail:ishrat_keka@yahoo.com; mrphy.ru@gmail.com;imatinbd@yahoo.com

Abstract:

An attempt to study the climate change of Bangladesh by using the surface climatological data such as Temperature, Rainfall and Pressure of 25stations for the period of 1971-2004. Analysis shows that the temperature rises all over the Bangladesh. The annual maximum temperature shows positive trends of +0.023 ^{0}C/year at Barisal and the other stations also shows positive trends except Mymenshingh and Sandwip. The annual minimum temperature shows positive trends at all stations of the study area except Hatiya, where trend value is -0.02 ^{0}C/year. The mean monthly maximum temperature shows its peak value in the months of April-May and the mean monthly minimum temperature has its lowest value in the months of December-February.

The co-efficient of variation of annual Rainfall range from (15-30)% over Bangladesh. The southeastern part of the country has the higher rainfall variability during post monsoon season. In the central part of the country, lower variability of rainfall occurs during winter season. The intensity of rainfall decreases from southeastern part towards the northwestern part of the country. Departure from normal annual rainfall (%) is maximum in southeastern part of Bangladesh. The northeastern zone of Bangladesh experienced drought condition in 1983, 1988 and 2004. In the northwestern zone of Bangladesh experienced drought condition in 1973, 1984 and 1987. Whereas, the southeastern and southwestern zone of Bangladesh experienced drought conditions in the year 1974 and 1973 respectively.

The variation of annual mean pressure anomaly increasing at stations Bhola, Bogra, Chandpur, Chittagong, Comilla, Dhaka, Feni, Ishurdi, jessore, Madaripur and Rajshahi and decreasing at Barisal, Cox's Bazar, Mymensingh, Patuakhali, Rangpur and Teknaf. Also the stations Dinajpur, Faridpur, Hatiya, Khulna and Sylhet indicates that no change of pressure anomaly with respect to different year.

Electric power generation from rice husk

Khursheed-Ul-Islam and *Shahidul I. Khan

German Technical Cooperation (GTZ), Dhaka,

*Department of Electrical & Electronic Engineering, BUET, Dhaka

Email: shahidul@eee.buet.ac.bd, dirces@buet.ac.bd

Abstract: This paper deals with the technical and economical feasibility of electric power generation from rice husk in Bangladesh. Such husk based power plants can be set up either as stand-alone or as grid connected power plants and could ideally be located in rice mill 'cluster areas' of the country. These power plants could be in the range of 200-250 kW or of 1-6 MW range. Analysis of material and energy balance related to production, basic design, various technology options and related financial options are also presented in this study.

The Potential of Electricity Generation from Poultry Droppings in Bangladesh

Sheikh Ashraf Uz Zaman[1] & M. A. Rashid Sarkar[2]

[1]Titas Gas T&D Co. Ltd., Email: sheikh958@hotmail.com

[2] Department of Mechanical Engineering, BUET, Email: rashid@me.buet.ac.bd

Introduction: Bangladesh is one of the low energy consumption countries in the world. Per capita energy consumption in Bangladesh is 197 kg of oil equivalent (kgoe), which is far less than the averages for low income (563 kgoe) countries. Around 33% of the total population is covered by electricity network and 4% are covered under natural gas network. About 40% of the total primary energy of the country comes from renewable energy, mainly biomass. Biogas is one of the promising renewable energy sources in Bangladesh. The country has a promising poultry industry to meet up the protein need of the people. There were about 130 thousand poultry farms in the country in 2005-2006. The number of birds in poultry farms was about 194.82 million in 2005-2006. These poultry farms have a huge potential to produce biogas which can later be used to generate electricity. At the same time the poultry farms in the country are facing enormous power shortage every day which hampers the production of the industry. Dissemination of the technology could meet the poultry sector's electricity demand as well as the need of adjacent households. This can reduce the burden on national electricity grid and contribute to the national economy as well.

Methods: To find out the economic potential of electricity generation from poultry waste, two different scenarios and four different cases were considered. These scenarios are based on the time duration for which the poultry farms can produce the electricity for its own consumption as well as to sell the excess electricity to adjacent neighbors through the mini grid. The cases were based on the product through which revenue can be generated. These different products are electricity, CO_2, and fertilizer. On the basis of different assumptions NPV, IRR and Payback Period were calculated for poultry farms ranging from 500 birds to 50000 birds. The calculation was done to find out the minimum sizes of poultry farms which could produce electricity with financial viability.

Results: The poultry farms ranging from 500 birds to 50000 birds are not financially feasible to produce electricity in the case when only electricity is considered as a product to earn revenue. In addition of CO_2 cost with electricity cost makes the farms financially viable with a capacity of 6000 birds and above if electricity is produced for twelve hours a day. In addition of fertilizer cost in stead of CO_2 cost with electricity cost, makes the farms financially viable with the capacity of 1000 birds and above. Finally, the addition of CO_2 cost with fertilizer and electricity cost also makes viable the farms with the capacity ranging from 1000 birds and above. However, the farm with capacity of 500

birds or less are not financially viable even if considering CO_2, fertilizer and electricity all together as product to earn revenue.

There is no economic potential in the country to produce electricity from poultry waste in the case when only electricity is considered as a product to earn revenue. The maximum estimated potential to produce electricity in the country is 360 GWh/year provided fertilizer cost is added with electricity cost irrespective of numbers of hours of electricity generation.

Conclusion: In conclusion it can be said that there is a potential to produce electricity from poultry waste. However, only electricity as a product to earn revenue in not enough to make the poultry farms financially viable to produce electricity. Fertilizer is the most vital element as a product to earn revenue with electricity to make poultry farms financially feasible to produce electricity.

Activities of Coromarent in sunshine

Nurjahan Sarkar

Dept. of Zoology, University of Dhaka

Electricity generation by Photovoltaics from sun – can be the driving force to meet the current power crisis in Bangladesh.

Subrata Kumar Sarker

POWERSOL, New D.O.H.S., Mohakhali, Dhaka - 1206

ABSTRACT

Now – a – days power failure or load shedding has become the common phenomenon in Bangladesh whether in metropolitan area or in rural area. Electricity coverage is 42% only and per capita electrical consumption is about 140 kWh, both of which are the lowest in the world. The growth of industrialization is not satisfactory due to power crisis. Only about 13% electricity is being consumed by the industrial sector. A large portion, about 83% is being consumed by domestic purpose. But if we can introduce alternate source for household consumers then a large volume of electricity can be transferred to the industries. Here photovoltaics can play the vital role. PV cells produce electricity directly from sun, they are easy to install, play as the own power source of consumers and hence the owners of the system can regulate the whole system. Bangladesh has a good opportunity to produce electricity directly from the sun round the year. I have focused in my paper about introducing PV generated electricity mainly at the metropolitan areas. If we can produce electricity from the sun by placing Photovoltaics at the roofs/walls/sun slates of the buildings, offices, divider of the roads, bank of the rivers and so on then power crisis can be solved. On the other hand reserve of fossil fuel will not disturbed and can be stored for future. Again Photovoltaics generated electricity will not produce CO_2, SOx (mainly SO_2 and SO_3) and other gases which make the earth warm. So by the use of photovoltaics environmental stability will also facilitate.

Mitigating grid energy related GHG emissions through solar energy

H R Ghosh, N C Bhowmik and J Rahman*

Renewable Energy Research Centre

*Dept. of Applied Physics, Electronics and Communication Engineering

University of Dhaka

Abstract:

An inventory of greenhouse gas emissions from grid connected electricity industries has been conducted following the guidelines set by the World Meteorological Organization and United Nations Environment Programme International Panel on Climate Change. The inventory indicates that the fossil fuels combination (4% Hydro, 7% Oil and 89% Natural gas) of the national grid of Bangladesh emits 0.452 ton CO_2/MWh and the 20062MKWh grid's energy consumption produces 9 million tons CO_2. To reduce emissions from electricity generation, one renewable energy option- solar energy resource has been assessed. The assessment shows that the solar energy resource of 4-4.5kWh/m^2/day can be effectively used in power production from grid connected or off grid power stations over the year and have a good potential in mitigation of GHG emission.

Modeling a Drip Irrigation system powered by renewable energy source

H RGhosh, N C Bhowmik, J Rahman and M Hussain

Renewable Energy Research Centre, University of Dhaka

Abstract:

Watering vegetable fields is generally done in the morning and the afternoon in little amount in comparison with that of the corn fields. A study on a model of drip irrigation system has been carried out in this research work. The available solar radiation of 2.3 kWh/m^2 in the morning (7-11am) and in the evening (2-5pm) at Dhaka shows that a 50 Wp module is good enough to pump 3000L water from 3 meters depth. Like other solar pumping systems this system will manage the electrical section, but the automatic evenly water distribution will be done with a mechanical water sprinter.

Daily global radiation tilt factor for Dhaka

H.R Ghosh, S K Khadem, N C Bhowmik and M Hussain

Renewable Energy Research Centre, University of Dhaka, Bangladesh

E-mail: hrghosh@yahoo.com

Abstract:

It's a common practice to tilt the solar radiation collecting surfaces at latitude angle to get optimum radiation over the year. For Dhaka computations for available radiation on tilted solar collector surfaces have been made for different tilt angles using the measured global and

diffuse radiation data of 2007 to optimize the tilt. It is found that 10^0 tilt in summer and 40^0 in winter time gives highest value of incident radiation, 4.5% more than that of the fixed tilted surface. The computed values have been compared with the measured tilted surface (10^0 tilt for summer and 40^0 for winter months) radiation values and have found them within 0.12 rms error. The tilt factors for different months using 40^0 tilt for Mar-Sep and 10^0 tilt for Oct-Feb will help one in calculating tilted surface radiation from available solar radiation data, will make maximum utilization of the solar systems and a good contribution GHG emission mitigation.

Climate Change Mitigation : Role of Renewable Energy

Md.Golam Mowla Choudhury

Professor, Department of Electronic and Telecommunication Engineering

Daffodil International University, Dhaha.

Abstract

When viewed from space, Earth is remarkably beautiful, and as we know, very hospitable to life. However, Earth's atmosphere is only a very, very thin layer covering land and water surface. All of us who live on the surface must be grateful for the protection of this atmospheric layer which lies between us and the vacuum of the outer surface. Without it, life as we know it would not exist.

Human activities are now clearly threatening the very atmospheric life support system of mankind. If we allow to continue with this what will life be like in the year 2050? Perhaps not too pleasant! We could expect routine health advisory notices warning the public of high radiation counts and requesting to stay indoor between the hours of 10.00am and 3.00 pm. We could expect to see very major increases in suffering from skin cancer. We can expect to see major increases in the infectious diseases and decrease in effectiveness of vaccination program. There will be reduction in the productivity of the oceans, in the yield of crops. This will adversely affect every human being in every region on this planet. We may expect to see frequent storm, hurricane of higher magnitude, draught, floods etc.

This is not the kind of world we want to bequeath to future generations. Therefore, we must take prompt and appropriate action to stop this global experiment with the lives of our children and future generations

To mitigate climate change and to stabilize greenhouse gas atmospheric concentration, it is required to reduce green house gases emission and other energy-related carbon dioxide emissions. Development and deployment of improved and new low carbon energy technologies are needed. Besides reducing greenhouse gas emissions, improved energy technology and the use of renewable energy (clean energy) can enhance energy security and environmental protection, and provide co-benefits such as improved air quality.

Renewable energy effectively uses natural resources such as sunlight, wind, rain, tides and geothermal heat, which are naturally replenished. Renewable energy technologies range from solar power, wind power, hydroelectricity/microhydro, biomass and biofuels for transportation. Renewable energy technologies are sometimes criticized for being unreliable or unsightly, yet the market is growing for many forms of renewable energy.

Determination of the long-term trend of Green House Gas emissions from energy sector of Bangladesh

Farid Hossen Khan, A.B. M. Obaidul Islam and S. Akbar[1]

Department of Physics, University of Dhaka, Dhaka-1000, Bangladesh

Bangladesh Atomic Energy Commission

E-12/A, Agargaon, Shere-Bangla Nagar, Dhaka-1207, Bangladesh

ABSTRACT:

Globally, energy sector is identifies as one of the main sector of green house gas (GHG) emissions. Developed industrial nations are responsible for reducing GHG emissions as per Kyoto Protocol. However, the developing nations are not bounded to reduce the GHG emission but there economic development will be influenced by the GHG mitigation strategies of the developed nations. Moreover, the developing nations are expected to get financial and technological support demy Kyoto and post Kyoto phases. Recently, many developing countries have given attention to the study of GHG emissions and finding the alternative paths for GHG mitigation. Like many developing nations, it is important for Bangladesh to estimations the GHG emission level, future trends of GHG emissions and to identify mitigation options. Energy is the vital proportion for the socio economic development of Bangladesh and this sector is developed rapidly. It is important to study and to estimate the GHG emissions of this sector. It is also needed to identify and to explain the different mitigation options for developing mid term and long-term energy sector of the country. We propose an energy chain of the country. The energy chain consists of all types of energy resources and techniques of resources extraction, transportation, installation, generations and uses of all form of energy. We apply the numerical model ENNPEP (Energy and Power Evaluation Programme) to the proposed energy chain to estimate the GJHG emission level and to identify the energy generation technology and primary energy resources for mitigation of the GHG emission gaining a sustainable long-term energy development of our county. This ENMPEP model is enabled us to make a projection of GHG emission for the period 2004 to 2034. It is found form the estimated results that the rate of increment of CO2 emission is very high wh9ich will increase about 35% form the present level (2004) to the year 2015. It is seen that the other GHG gases such as CH4, N2O, NOX and particulate matters are also increased significantly. We have investigated to find out the mitigation options from different energy sectors of GHG emissions. We have found that the nuclear energy and solar will play a vital role in generation of electricity, natural gas in the transportation and high efficient biomass for cooking and other household activities.

Self – Similar Nature of Solar Radiation: Modeling and Estimation

[1]Runa Rokshana Khan, [2]Md. Muhidul Islam Khan, [3]M. Ismail Jabiullah and [4]Shahida Rafuque

[1, 2, 3] Institute of Science and Technology

[4] Department of Applied Physics Electronic and Communication Engineering

Dhaka University

Abstract: Self- Similar nature of solar radiation on has been observed in a time- seines data from 1988 to 2007. The mean, variance, auto correlation, auto covariance, etc, have been computed using statistical model. It has been realized that the structure of radiation shows similarity at arbitraril small scales. The structure repast that is it contains smaller replicas of itself at all scales. The deterministic self –Similar signal has been found to be invariant with respect to, time. The computed auto connivance shows a long – range dependence. To determine the self- Similarity in the time seines data, Valiance time plot has been done. The technique utilized are visual observation, in the traffic appears visually similar many time scales. Visual observation is used with other techniques such as R/s plot, Variance time ;lot and Hrs Parameter H.

Contribution of LGED to disseminate RETs in Bangladesh

Mir Tanweer Husain

Sustainable Rural Energy

Local Government Engineering Department

Among the Government departments **LGED** has played the leading role to demonstrate renewable energy technologies in Bangladesh. The goal of **Sustainable Rural Energy** project was to develop community based models of renewable energy as an alternative source of rural energy in the off-grid areas of Bangladesh. Its main objectives were **demonstration of renewable energy technologies**, **capacity building for technology transfer** and **wide dissemination of those techno**logies in the off-grid areas. Initial budget of the project was 0.94 million US$ whereas the revised budget was 1.99 million US$. However fund utilization was more than 90% over the period of eight years.

Overall achievements of Sustainable Rural Energy (SRE) project could be summarized from the successful interventions of Renewable Energy Technologies (RET), capacity building and adaptation of RETs by peoples in the off-grid areas. Technology wise demonstrations encompassed 40.5kWp solar photo voltaic installations, 10kW wind-solar hybrid, 12.5kW power generation from biomass resources and 10kW from micro hydro intervention. As a part of technology transfer 1545 man days training were provided to the technical professionals and beneficiaries. Moreover SRE has published 11 brochures on different RET installations, one book on "Green Energy Development Model in the St. Martin's Island" and published off-grid area maps of Bangladesh. Besides that to address information barrier SRE has successfully hoisted a web portal named Renewable Energy Information Network (REIN), [www.lged-rein.org]

Sector wise Achievements:

A) Technology Demonstration:

The pilot demonstrations of renewable energy technologies such as Solar, Wind, Biomass and Micro-Hydro interventions have been successfully completed on the basis of available renewable resource in the off-grid areas. Replication potentials have been observed from the following installations.

Solar Energy: Total 40.5 kWp solar photo voltaic units have been installed within the project period. It encompassed diversified application of PV to illustrate solar home systems, growth centre electrification, cluster village power supply, electricity supply to the tourist resort, rural clinic, local govt. institutions, tribal community, rural water supply etc; there are 4500 direct and about fifty thousand indirect beneficiaries.

SRE has installed 2.6kWp stand alone SHS in 35 houses of Baliadangi village in Thakurgaon district and 1.7kWp SHS to a cluster village in Sherpur. The interventions have improved quality of livelihood of the villagers. They can now watch National TV/radio broadcast and integrate them with the social welfare, health, sanitation, education and family planning programme. Installation of 225Wp solar lighting system has increased tourism facilitates at Goznee resort, in Sherpur. The first 1.8 kWp centralized solar power supply unit at Gangutia growth center has promoted income generating activities of 50 shop keepers and extended their evening time business hours. This has also created enthusiasm and awareness among the buyers, general public and local market management committee. Similar market electrification facility has been sought by the politicians to the other off-grid markets. The 5kWp centralized A/C solar power unit at Chokoria, Cox's Bazar was the mile stone intervention of mini grid system in our country. The project is now entrusted to the beneficiaries for ownership development and sustainable operation and maintenance of the unit. Seventy two families have been directly benefited from the system. Village women can now put extra effort for earning after the dusk. The students also get uninterrupted study hours at the evening. The 1.5kWp solar powered rural health clinic at Kamarul is another bright example of improving medical facilities of about thirty thousand people of that community. For instance major operation such as cesarean, gallbladder stone, appendicitis surgical facilities are now available at that health centre. 600Wp Solar PV demonstration at the Kamarul Union Parishad, Kushtia provided effective governance at the grass roots level. 375Wp solar PV improves IT facilities at Kutubdia LGED Office. Besides that SRE has installed 10 kW pilot wind-Solar hybrid power generation units at the St. Martin's Island. This intervention has a significant impact to promote eco-tourism and conservation of bio-diversity in the island. Beauty of wind-solar hybrid is that generally when wind speed is high solar irradiation is low and vice versa. Again there are considerable amount of wind speed at night when no solar irradiation at all. Therefore we could store energy in a battery bank and use it when needed. The first SPV pumping project was installed at the 'Barind' region of Rajshahi division. This system has 6kWp solar PV consequently it could lift about fifty thousand liters of water per day from an average depth of fifty meters. Moreover renewable energy interventions at Nijampur Matsha khamar unvail opportunity of public-private partnership.

One of the major barriers of adopting SHS is its high upfront cost. About eighty percent of its cost is due to the price of PV module and the battery. In that case, if size of the system is

reduced by providing LED instead of DC fluorescent lamp, price of the system could be significantly cut down to affordable limit. To address this intervention SRE has installed five hundred LED based home systems. Some of the system appliances were DC LED lamp and some of them were LED lantern. Before wide dissemination of this new design the project will be closely monitored by some NGOs. If successful, those LED based solar home system would be a land mark to foster solar home lighting system.

In short, solar energy interventions replace fossil fuel and directly reduces considerable amount of green house gasses eventually keep our environment healthy. The installations were entrusted to the beneficiaries for proper operation and maintenance. This help to build a sense of ownership and technology transfer.

Wind Energy: In order to harness wind power it is very important to have reliable wind data for a consecutive period of at least four years. To keep it in mind SRE, with collaboration of BUET have installed twenty wind monitoring stations throughout the country. Wind data are now being taken by GIS unit of LGED. Ultimate objective of this project is to produce Wind Energy Resource Mapping of Bangladesh. Meanwhile SRE has installed some low cut-in speed wind mill to lift ground water and seven small wind turbines at the St. Martin's Island. Each of the turbines has 3.2kW capacity at a rated wind speed of 10.5m/s.

Biomass Energy: SRE has installed 10kW power generation unit which was based on poultry litter. Excess gas from this unit is being used for cooking purpose at the Faridpur Muslim Mission. There are huge replication potential of such type of bio-energy in our country. Demonstration of 3.5kW cow dung based power generation unit at Netrokona district created enthusiasm among the small scale farmers. Besides that SRE has also installed two biogas units one at Kutubdia and the other at Kishoregonj which were based on human excreta. This type of interventions created better health and sanitation facilities as well as energy requirement for cooking and lighting. Furthermore SRE has installed one pilot biomass gasifier at Faridpur Muslim Mission. This gasifier could save up to 50% fuel wood.

Micro Hydro Energy: SRE has successfully demonstrated first micro-hydro power unit at Bamerchara, Chittagong. Its installed capacity was 10kW but due to inadequate water head about 4kW power was generated. SRE has also carried out a study on prospective micro-hydro sites in the Chittagong Hill Tract reasons and eight potential sites were identified with an estimated capacity of 135kW. SRE also provided technical support to promote indigenous micro-hydro power generation unit which was developed by member of local indigenous community named Mr. Aung Thui Khoyan.

B) Capacity Building and Technology Transfer:

Total 1545 person days training were provided to the LGED officials, technical professionals and the beneficiaries. In addition to that one fellowship at the post graduate level and five overseas short courses/ workshops were also supported by SRE.

C) Publications and dissemination of RETs:

To remove information barrier and for wide dissemination of renewable energy technologies SRE has hoisted a web portal named Renewable Energy Information Network (REIN) [www.lged-rein.org]. Information on the web is normally updated once a week. Information were tailored specifically to meet the needs of energy planners, project developers, researchers, politicians, enthusiasts and all relevant organizations in developing, mainstreaming of renewable energy technologies in Bangladesh.

In addition SRE has created mass public awareness about renewable energy technologies by participating in the national exhibitions, distributing of brochures and news letters. About 25,000 copies of brochures, 7500 copies circulation of Bangladesh Renewable Energy Newsletter (BREN) were distributed during the project period. Besides that SRE has organized seven national and one international workshop.

Finally we could conclude by saying that SRE has achieved its target to successfully create public awareness and dissemination of renewable energy technologies in Bangladesh.

RAHIMAFROOZ
SOLAR

Delta Diagnostic Centre

Dhap, Jail Road, Rangpur