

Renewable Energy: An Ideal Solution of Energy Crisis and Economic Development in Bangladesh

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Abstract

Present world is moving fast towards development of civilization. Industries, factories, power plants, various government institutions, scientific institutions, private organizations are growing up on the basis of available natural energy sources. However, these sources are limited and expensive. CO₂, CFC and other harmful gases are being produced through the utilization of these sources. Air is being polluted through these gases. So renewable energy will be the best solution. Developed countries are searching for newly alternative energy sources to minimize the pressure on natural sources like gas, oil, coal etc. Developing countries like Bangladesh are also trying to utilize different renewable energy sources to fulfill their growing demand. Bangladesh is a small country with a vast population. People have been suffering from insufficient electricity for many years. To meet the energy crisis Bangladesh has been experienced to renewable sources like biogas, bio-fuel, solar energy, wind energy, tidal energy, geothermal power, hydro power etc. In this paper we have tried to analyze about renewable sources of the country. Here we have identified the utilization of renewable sources and their benefits. This paper also belongs to subject that how far renewable energy can be treated as an ideal solution of economic development.

Index terms— bangladesh, energy crisis, electricity, economic development, renewable energy, biomass, solar energy.

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Keywords: bangladesh, energy crisis, electricity, economic development, renewable energy, biomass, solar energy. 26° 03' North Latitude and 88° 01' and 92° 04' East Longitude with a total landmass of 1,47,570 square kilometers (56,977 Sq. miles). India on the West, North and Northeast, Myanmar on the Southeast and the Bay of Bengal on the South surround Bangladesh. Bangladesh has a tropical monsoon climate with heavy summer rain and high summer temperatures. Main seasons prevail in Bangladesh are summer (March-May), Rainy Season (June-September) and winter (December-February). 95% of the total rainfall, which averages

about 1733 millimeters, occurs during these B periods [1]. The temperatures range from an average of about 68 0 F(18 0 C) in January to about 86 0 F (30 0 C) in April [1]. Bangladesh is an agrobased country. Her economy depends on agriculture. Production needs sufficient electricity. But failure of power creates a bad impression on production. About 70% people of the rural area are deprived from electricity [2]. They depend on conventional energy sources-near 70% energy comes from these sources [3]. Electricity generation rate is less than the huge demand.

To meet the demand Government of Bangladesh is using natural sources like gas, oil, coal etc. Bangladesh has huge reserve of gas, limited reserve of oil and coal. According to the Gas Initially in Place (GIIP) data, Bangladesh has 21.3 tcf of proven gas (P1; proved or with probably of 90 percent of greater or equal volume). Out of which 15.4 tcf is recoverable and 7.7 tcf of gas has already been produced [4]. The total coal reserve is estimated to be 2.9 billion metric tons [4]. Bangladesh imports 1.2 million tons of crude and 2.5 million tons of refined oil each year. The source of gas (24%) may be depleted nearby 2020 [5]. Huge amount of imported oil costs a lot of foreign money. To take coal through digging from soil is very much expensive and this process may be harmful for climate. Therefore, energy crisis becomes a major concern now. About 53% of total electricity comes from public sector and 47% of the rest electricity comes from private sector [6]. Due to the geographical location Bangladesh has potentiality of renewable energy. Several government organizations such as Electric Supply Authority (DESA), Rural Electrification Board (REB), Local Government Engineering Department (LGED), non government organizations and private companies such as Grameen Shakti (GS), Bangladesh Center for Advanced Studies (BRAC), Centre for Mass Education in Science (CMES) etc are involved in the renewable sector of the country. Renewable energy can be a good solution of energy crisis, which has less impact on climate. Different forms of renewable energy source can provide sufficient power to urban and remote areas. It can also reduce the pressure on natural sources and can help to save foreign currency. Previous works have done to recognize the [6]. Vast rural areas are being affected by load shedding. Due to power failure irrigation, production of products, water supply and daily activities are being disturbed. To solve the crisis government has planned to install power plants with capacity of 14720 MW by the year 2016 [6]. But there is a huge gap between generation and demand. Huge amount of power loss is occurred through transmission. Most of the power plants are old. Generation rate of these power plants is lower than newer plants. Most of the power plants are gas and oil based. Rental power plants are set up to meet short-term and emergency requirements of the country, which seems to be costly. Here figure-1 [4]. shows energy sector of Bangladesh and in table-1 [4] shows electricity generation through various sources. The given table-2 [7] presents power generation capacity. According to the Master Plan 2010, the forecasted demand would be 19,000 MW in 2021 and 34,000 MW in 2030 [7]. This plan insisted to use domestic coal 30%, imported coal 20 %, natural gas (including LNG) 25%, liquid fuel 5%, nuclear, renewable energy and power import 20% [7]. renewable energy sources of Bangladesh and some difficulties to establish project in rural areas. This paper reviews present condition of energy crisis and possible application of renewable sources in Bangladesh. This paper also indicates the beneficial aspects of renewable energy for the people of Bangladesh. Bangladesh has strong potential for biomass gasification based electricity. More common biomass resources available in the country are rice husk, crop, residue, wood, jute stick, animal waste, municipal waste etc. Exploration of these resources for electricity generation is still at preliminary stage. Biogas is composed of CH₄, CO₂ and other gases, which can be produced by cattle dung, poultry droppings, human excreta and agricultural residues. The digested slurry obtained as a byproduct which acts as a nutrient-rich fertilizer [8]. Bangladesh is in a suitable position for availability of raw materials and the climate conditions for biogas production. About 29.7 billion m³ Significant amount of power can be produced from biomass energy. It can be used in some applications as well as in small household works, cooking, harvesting, lighting, irrigation etc. A fig-2 [11] shows the utilization of biogas in a house.

1 Wind Energy

Recently Bangladesh gets experiences on wind energy. Several locations have already been assessed to evaluate the wind energy potential of the coastal region of the country. Strong wind potential flows during the months of April to September, and a very weak potential during rest of the year. Table-1 shows wind speed [12] in Kuakata. Wind Resource Assessment Station (WRAS) established by BPDB at Moghnama Ghat, Cox Bazar district in December 2003. For the first time in Bangladesh, BPDB implemented a pilot project of 0.90 MW capacity of the cubic meter digester volume was built at dholpur, Dhaka to produce 200 cft biogas from garbage [9]. About 17194 biogas plants were established under a project of IFRD in 2004 [10]. In 2004, Sustainable Rural Energy (SRE) project under LGED has installed 10KW power generation unit, which was based on poultry litter. Excess gas from this unit is being used for cooking purpose at Faridpur Muslim Mission. SRE has also installed two biogas units, one at Kutubdia and the other at Kishoregonj which were based on human excreta. This type of inventions created better health and sanitation facilities as well as energy requirement for cooking and lighting. Demonstration of 3.5KW cow dung based power generation unit at Netrokona district created enthusiasm among the small-scale farmers. Beginning from June 2006, over 10000 biogas plants were constructed under National Domestic Biogas and Manure program (NDBMP) [9]. According to the renewable energy policy, govt. has planned to develop biogas plants to produce at least 500MW power by 2015. Fig- 2 shows installation of biogas plants. V.

2 Solar Energy

Solar power is the conversion of sunlight into electricity, either directly using photovoltaic (PV), or indirectly using concentrated solar power (CSP). Concentrated solar power systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. Photovoltaic converts light into electric current using the photoelectric effect. Average daily solar radiation is 4-6.5 kWh/m in Bangladesh. The first significant program of solar system was Norshingdi project. Under this project, solar home systems (SHS) with a total capacity of 32.586KWp were installed [15]. Under Renewable Energy Technologies (RET) 40. [18]. Now 30% household works can be done through SHS system [19]. Due to geographical location, Bangladesh has huge opportunities to use solar energy. Instead of having some bad impact on climate as well as CO₂ impact however the blessing of solar energy is untold [32]. So far this energy can be utilized in many activities of daily life as solar lighting, pumping, irrigation, solar park, poultry-farms, small dc applications etc.

3 b) Benefits of Solar energy

Most of the rural areas where people are suffering from energy crisis, solar energy can bring them solution through its some benefits as: ? Solar energy is free although there is a cost in the building of "collectors" and other equipment required to convert solar energy into electricity or hot water. ? Solar energy does not cause pollution. However, solar collectors and other associated equipment/ machines are manufactured in factories that in turn cause some pollution. ? Solar energy can be used in remote areas where it is too expensive to extend the electricity power grid. ? Low cost and easy installation. ? Could be an effective alternative source of energy. ? Energy can be stored in the battery. Geothermal energy is very much cost effective and environmentally friendly thermal energy generated and stored inside the earth surface. To generate electricity, the steam and hot water produced inside the earth surface is used in this technology. Geothermal energy is a reliable source of power that can reduce the need for imported fuels for power generation and emits almost no greenhouse gases. As renewable, it based on a practically limitless resource of natural heat within the earth. Geothermal energy is generated about 4,000 miles below the surface, in the earth's core. The process takes place due to the slow decay of radioactive particles, the high temperature produced inside the earth and it happens in all rocks. About 10,715 megawatts (MW) of geothermal energy is generated in 25 countries worldwide [21]. The first geothermal power plant for electricity generation in Bangladesh is under construction, which will thus become the twenty-sixth country in the world to use this source of renewable energy [22]. The northern districts of Bangladesh show the prospect to explore the geothermal resources. Also there is a hot salt water spring known as Labanakhya at Sitakunda (40 kilometer from Chittagong) which has the possibility to Figure ?? : Geothermal map of Bangladesh [24]. The establishment cost of geothermal power plant is high due to the high cost of drilling wells, it can be reduced by using the abandoned on shore dry wells which have sufficient high temperature gradient (like over 30K/km) [23]. Geothermal energy can provide a suitable energy solution for Bangladesh as it is green, indigenous, abundant, continuously available and independent of climate changes [23]. With the population of over 156 million inhabitants, it must be noted that 200MW are not sufficient to consider the solution of energy crisis where the total installed power capacity is currently about 6000 MW [22].

4 VII.

5 Hydro Power

Flowing water creates energy that can be captured and turned into electricity. This is called hydroelectric power or hydropower. It is an eco-friendly clean power generation method. As a riverine country, Bangladesh is a great delta formed by the alluvial deposits of the three mighty Himalayan Rivers: the Ganges, the Brahmaputra and the Meghna [25]. Also there are lots of canals, tributaries of main river Karnafuli, Shangu, Matamuhuri as well as tiny waterfalls having good potentials for setting up mini/ micro hydropower unit in Chittagong Hill Tracts (CHT) region [26]. At present only 230 MW of conventional hydro power is utilized in the Karnafuli Hydro Station, which the only conventional hydro-electric power plant in the country operated by Bangladesh Power Development Board (BPDB). BPDB is considering extension of Karnafuli hydro Station to augment another 100 MW capacity, which will add energy marginally, but will be effective to operate it as a peaking power plant. The additional energy will be generated during the rainy season when most of the water is spilled [8]. Classifications of hydro power based on generated power are as follows: Pico-Hydro<5KW micro-hydro>5<300KW Mini-hydro>300KW <3MW Small hydro > 3MW < 10MW

Bangladesh Water Development Board (BWDB) and Power Development Board (BPDB) carried out a joint study on Micro-Hydro power potential in the country. In Table-4, it is given in detail [23]. be an excellent location for the extraction of geothermal energy, and so further investigation is required to fully evaluate its potential. Recently, the Ministry of Power, Energy and Mineral Resources has approved the establishment of the first ever-geothermal power plant in the country [23]. The demand of electricity in urban as well as in the rural areas are increasing, but our production of electricity is not increasing. The rural demand for electricity can be covered by the production of electricity through geothermal energy. A private company named Anglo MGH Energy has planned to setup Bangladesh's first geothermal power plant with a capacity to produce 200 MW. Plants for 200 MW are in the pipeline at Salandar village in the northern district of Thakurgain [22]. The company has done

primary feasibility studies on the plan and will conduct a final one shortly on a span of 3500 hectares of land to select the spot for the plant. The Company has secured favorable opinions from the Geological Survey of Bangladesh, the Ministry of Water Resources and the Ministry of Environment and Forest [22]. According to the plan, 28 deep tube wells will be dug to lift hot steam to run a turbine connect to the generator to generate electricity, whose temperature will be at least 12 degree Celsius. These geothermal resources can therefore play a significant role as regards energy supply for populated areas, where there is a severe shortage of energy in general and specifically of electricity. Fig- ?? shows geothermal energy prospects of Bangladesh (Guha et al., 2010) ()

6 Dis trict

Year SRE under

LGED has successfully demonstrated first micro-hydro power unit at Bamerchara Lake, Banshkhal, and Chittagong district in Bangladesh. Its installed capacity was 10kW but due to inadequate water head about 4kW power was generated. Estimated capacity of the system was 10kW. Salient feature of the unit has been illustrated below [26] There are many rivers with high flow rate in monsoon but low in winter. It would be a good idea to create a diversion structure across the river channel, diversion channel along the bridge and the powerhouse at a suitable location that offers a suitable head. The Teesta Barrage, the largest irrigation project of the country has several sites with sufficient head. BPDB has submitted a proposal to the government to install a 25kW power plant at the Teesta barrage. Further investigation can open the door to more success in this regard. To improve development outcomes, Bangladesh has good potential of hydro power through micro/ mini hydro power and its proper utilization can bring effective changes to energy sector in upcoming days.

7 VIII.

8 Economic Development

Now Bangladesh has started to have advantages of renewable energy. Day by day, it becomes cheaper. Rather than high power equipments, long transmission and distribution line and other installations, it becomes easier to set up. Due to fall in price, people become interested in biomass and solar energy. This motivation saves money and makes our life easier. This also influences our social and economical activities. Renewable energy reduces dependency of natural fuel. Employment opportunities are increasing for rural people. Especially green jobs where people can produce harmless chemical pesticides and fertilizer, Compact Fluorescent Light (CFL) to reduce 80% of electricity cost [30]. Here fig- 9 illustrates employment estimation through renewable energy.

IX.

9 Conclusion

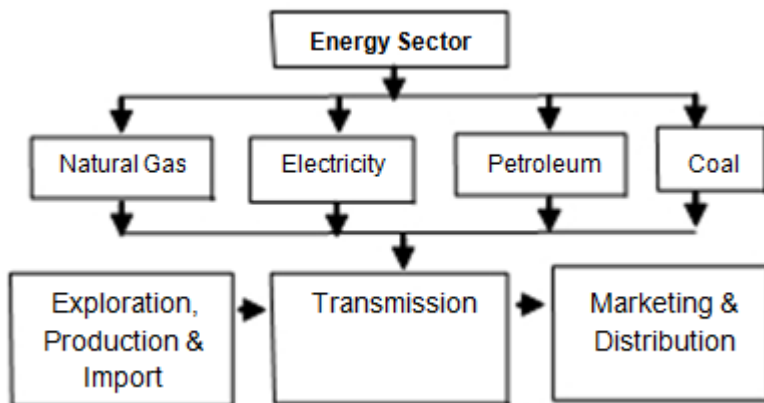
Bangladesh, the land of natural resources, rich in gas, limited amount of coal, oil as diesel and kerosene. These natural resources are stored in deep soil and sea blocks. As if, carry out these resources through open access digging from soil is very much expensive and harmful for environment. For this Proper utilization and installation of biogas plants, solar panels and wind turbines could be cost effective for our economy. Bangladesh is mainly dependent on natural gas and imported oil. Excessive use of natural energies Product). A prediction estimates that maximum reserve of natural energy sources will deplete within few decades. So dependency on natural sources should be reduced. If we create diversity to renewable energy then it will be our achievable energy sources in near future. However, Economic development through renewable energy can play a vital role to reduce unemployment and poverty, which is helpful for Bangladesh to continue her journey with global world.

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1

Figure 1: Figure 1 :



2

Figure 2: YearFigure 2 :

Source of Energy	Installed Capacity (MW)	% of Total Installed capacity	Present Capacity	% of Present Capacity	Shutdown Capacity (MW)	Running Capacity (MW)	% of Total Running Capacity
Gas	4847	74.38	4412	74.21	792	3620	74.23
Coal	250	3.84	220	3.70	100	120	2.46
HFO	275	4.22	271	4.56	0	271	5.56
HSD	594.5	9.12	567	9.54	16	551	11.30
FO	170	2.61	95	1.60	60	35	0.72
GT	150	2.30	150	2.52	0	150	3.08
Hydro	230	3.53	230	3.87	100	130	2.67

Figure 3: Figure 3 :

Public Sector		
SL.		Generation Capacity (MW)
1	BPDB	2868
2	APSCL	659
3	EGCB	255
	Subtotal	3782 (53%)
Private Sector		
1	IPPs	1231
2	SIPPs (BPDB)	99
3	SIPPs	226
4	15 YR. Rental	168
5	3/5 YR. Rental	1613
	Subtotal	3337 (47%)
	Total	7119

Figure 4: Figure 4 :

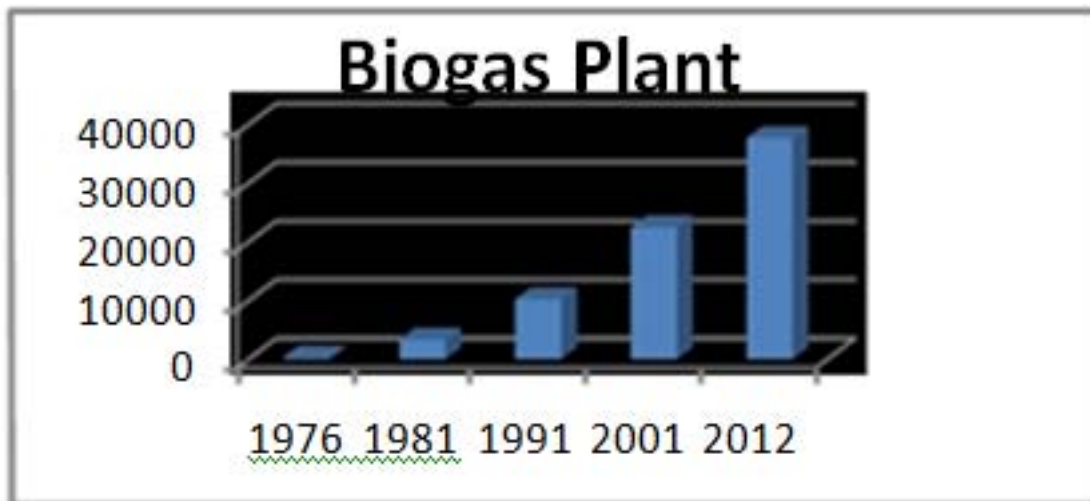
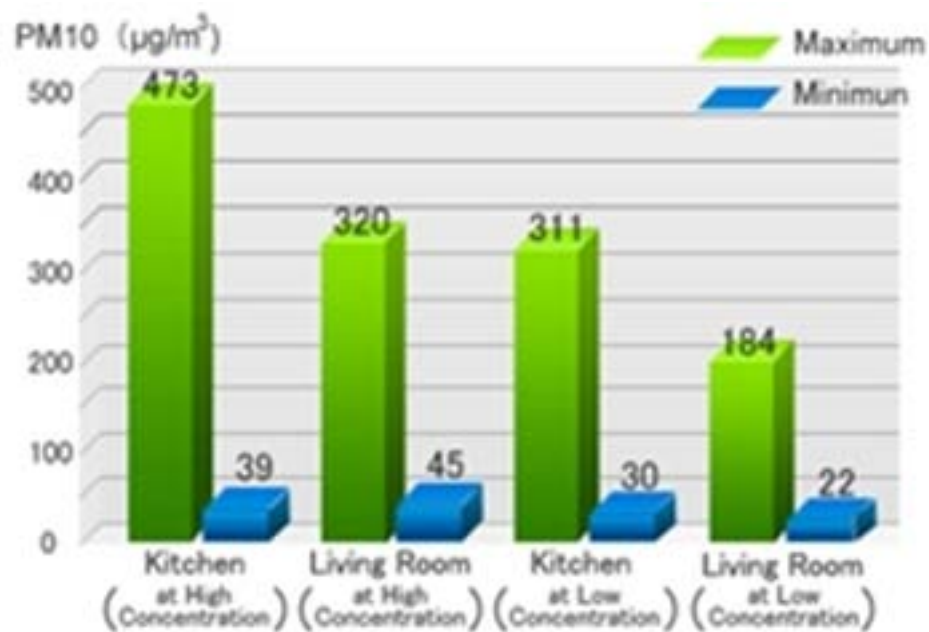


Figure 5:



5

Figure 6: Figure 5 :

Month	Wind Speed (m/s)
January	5.80
February	5.50
March	7.70
April	8.30
May	7.90
June	6.90
July	7.70
August	7.50
September	6.90
October	6.30
November	5.50
December	4.80

6

Figure 7: Figure 6 :

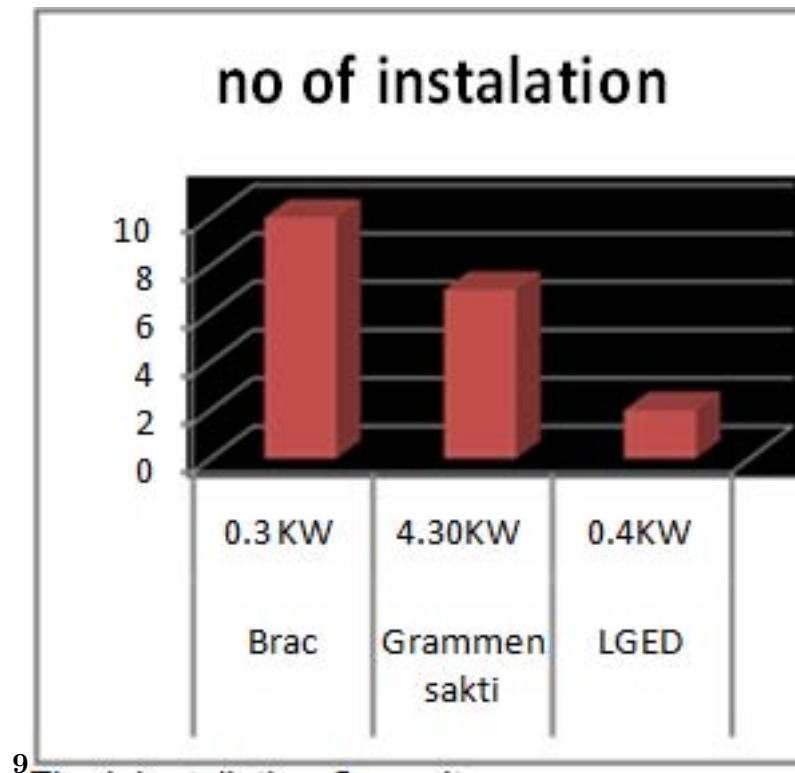


Figure 8: Figure 9 :

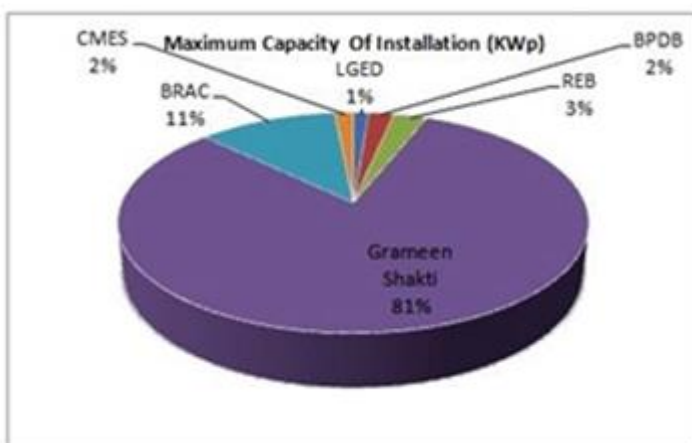


Figure 9:



Figure 10:

1

Figure 11: Table 1 :

2

III. Biomass & Biogas

Figure 12: Table 2 :

3

Figure 13: Table 3 :

4

	Name R iver/C hara P otential of E lectrical /stream	energy in K W
Chittagong	1. Foy”s lake	4
Chittagong	2. Choto Kumira	15
Chittagong	3. Hinguli Chara	12
Chittagong Hill Tracts	4. Sealock	81

Figure 14: Table 4 :

5

Figure 8 : Power generation capacity of Micro-Hydro plants

[Note: a) Ongoing Projects of Hydro Power in Bangladesh ? BPDB has taken steps to install 50-70 kW Mohamaya Irrigation-cum-Hydro Power Project at Mirersorai, Chittagong [28]. ? Rehabilitation of 50 kW Micro-Hydro Power Plant at Barkal Upazila of Rangamati district [28].]

Figure 15: Table 5 :

[Biomass interventions, Renewable Energy Information (REIN) , <http://www.lged-rein.org/-database.php?pageid=68> *Biomass interventions, Renewable Energy Information (REIN)*

[Solar Energy Programme, Renewable Energy Information Network (REIN) , <http://www.lged-rein.org/database.php?pageid=21> *Solar Energy Programme, Renewable Energy Information Network (REIN)* (RET projects in brief)

[Renewable Energy report, APCTT-UNESCAP ()] , *Renewable Energy report, APCTT-UNESCAP* 2009.

[Research Report: Energy Sector of Bangladesh by IDLC ()] , *Research Report: Energy Sector of Bangladesh by IDLC* 2011.

[Available at Error! Hyperlink reference not valid. Error! Hyperlink reference not valid. Error! Hyperlink reference not valid. Error! Hyperlink reference not valid. Error! Hyperlink reference not valid. Error! Hyperlink reference not valid, (Current status of Renewable energy across the globe & Bangladesh, EBIOZONE, The Growing Biological Sectors in World)

[Bangladesh joined the geothermal energy, reve, wind energy and electric vehicle review] *Bangladesh joined the geothermal energy, reve, wind energy and electric vehicle review*, <http://www.evwind.es/2011/04/04/bangladesh-joined-the-geothermal-energy>

[Khan ()] ‘Case study: battery operated lamps produced by rural woman in Bangladesh’. H J Khan . *Energy for sustainable Development* 2003. 7 (3) p. .

[Islama et al. ()] *Effective renewable energy activities in Bangladesh*, A K M Islama , Mazharul Islam , Tazmilur Rahman . 2005. ELSEVIER.

[Md and Mia] *Geothermal energy and it’s prospect in Bangladesh*, Bodruddoza Md , Mia . http://benjapan.org/-wea_files/23bodruddoza.pdf

[Md (2011)] ‘Impacts of CO2 emission constraints on penetration of solar PV in the Bangladesh power sector’. Md . *World Renewable Energy Congress* 2011-Sweden, 8-13 May 2011. (Alam Hossain Mondal)

[Improvement of Biomass Energy Utilization in Bangladeshi Homes] *Improvement of Biomass Energy Utilization in Bangladeshi Homes*, http://www.asiabiomass.-jp/english/topics/-0909_05.html

[Micro hydro interventions, Renewable Energy Information Network (REIN)] *Micro hydro interventions, Renewable Energy Information Network (REIN)*, <http://www.lged-rein.org/database.php?pageid=69> Bangladesh. (Joint Rivers Commission Bangladesh Ministry of Water Resources)

[Zubair et al. (2012)] ‘Optimal Planning of Standalone Solar-Wind-Diesel Hybrid Energy System for a Coastal Area of Bangladesh’. Ahmed Zubair , Aman Abdulla Tanvir , Md Mehedi Hasan . *International Journal of Electrical and Computer Engineering (IJECE)* December 2012. 2 (6) p. .

[Population Census Ministry of Planning ()] ‘Population Census’. *Ministry of Planning*, (Bangladesh Bureau of Statistics; Dhaka) 2011. 2011.

[Anam and Husnain-Al-Bustam (2011)] ‘Power Crisis & Its Solution through Renewable Energy in Bangladesh’. Khairul Anam , Husnain-Al-Bustam . *Cyber Journals: Multidisciplinary Journals in Science and Technology*, September Edition, 2011.

[Power Division, Ministry of Power, Energy and Mineral Resources, Government of the Republic of Bangladesh] *Power Division, Ministry of Power, Energy and Mineral Resources, Government of the Republic of Bangladesh*, <http://www.-powerdivision.gov.bd/user/brec/41/58>

[Nahid-Ur-Rahman Chowdhury and Syed Enam Reza ()] ‘Present Scenario of Renewable Energy in Bangladesh and a Proposed Hybrid System to Minimize Power Crisis in Remote Areas’. Nahid-Ur-Rahman Chowdhury , Syed Enam Reza . *INTERNATIONAL JOURNAL of RENEWABLE ENERGY RESEARCH* 2012. 2 (2) . (Tofaeel Ahamed Nitol)

[Md. Alim Iftekhar Rasel et al. (2012)] ‘Prospect of Renewable Energy as the Solution of the Existing Energy Crisis of Bangladesh’. Saiham Md. Alim Iftekhar Rasel , Siraj , Kazi Moshir Rahman . *International Journal of Scientific & Engineering Research* March-2012. 3 (3) .

[Md et al. (2012)] ‘Prospects and Potential Analysis of Solar and Biomass Energy at Pabna District, A Realistic Way to Mitigate District Energy Demand’. Md , T H M Islam , Sumon . *International Journal of Engineering and Advanced Technology (IJEAT)* December 2012. (2) .

[Renewable Energy Information Network (REIN)] *Renewable Energy Information Network (REIN)*, <http://www.lged-rein.org/database.php?pageid=67> (Available at)

[Islam et al. (2006)] *Renewable energy resources and technologies Practice in Bangladesh*, M Islam , M Islam , M Alam . July 2006. ELSEVIER.

[Uzzal Hossain et al. (2011)] ‘Renewable energy snapshot and prospect in Bangladesh’. Mohammad Uzzal Hossain , Md Joardder , Barun Shazib Uddin , Omar Kumar Das , Faroque . *ICMERE2011*) 22-24. *International Conference on Mechanical Engineering and Renewable Energy* 2011. December 2011.

9 CONCLUSION

- 259 [Dr et al. (2008)] *Role of Renewable Energy (Biogas and Improved Cook Stoves) for Creation of Green Jobs in*
260 *Bangladesh*, M A Dr , Md Rouf , Haque . 30th July, 2008.
- 261 [SECTOR: THE PAST, PRESENT, AND FUTURE OF RENEWABLE ENERGY TECHNOLOGIES BPDP ()]
262 'SECTOR: THE PAST, PRESENT, AND FUTURE OF RENEWABLE ENERGY TECHNOLOGIES'.
263 *BPDP* 2011. 2002. (8) . An Overview of Power Sector of Bangladesh
- 264 [Dr and Anwar Hossain] 'Wind Energy in Bangladesh'. Dr , Anwar Hossain . [http://www.sdnbd.org/wind.](http://www.sdnbd.org/wind.htm)
265 [htm](http://www.sdnbd.org/wind.htm) *Sustainable Development Networking Programme*