

A comprehensive study on electricity crisis of Bangladesh to be developed country and some proposals for removal of this crisis.

Md. Abu Zahed¹, Sujan Kumar Talukdar², Sazal Kumar Samadder³

Abstract—

Bangladesh has set off in the way of development and growth through liberation war of 1971. Power crisis is the main problem for making Bangladesh as developed country within twenty first century. In this composition we are representing present situation, generation, demand of electricity and some proposals to diminish this obstacle. We are highly hopeful these proposals will play a great role to reduce the problem. Only through the removal of electricity crisis Bangladesh would be established as a self-dependent and information technology enriched country in twenty first century.

Index Terms— Renewable energy, Nuclear power plant, Solar energy, Biogas energy, Wind energy, Hybrid power plant.

I. INTRODUCTION

Power generation is the only weapon for the complete economic growth of Bangladesh. Production rate of industries would be increasing through non-stop electricity supply which has a great impact on complete economy. On the other hand, we have mentioned in this thesis that here in Bangladesh 50% people are still out of the advantages of electricity. After keeping the greater number of people out of main stream of development, economic growth of a country cannot be imagined. Electrification should get priority for the national economic development of our country. Finally through increasing power generation, economy could be increased where renewable energy to be used, obsolete power plant to be established. In spite of having some limitations nuclear power plant installation endeavor would be an epoch making initiative to remove the power crisis in Bangladesh. The government of Bangladesh is working to provide more energy to its people to accelerate economic growth, social development and reduce poverty. On one hand, government is working to promote the use of renewable energy technologies. On the other hand, the government

works with industry public sector power utilities and provide households to increase the use of energy efficient appliance and production process and promote energy generation. Renewable energy and energy efficiency is a priority of Bangladeshi –German development co-operation.

II. PRESENT ELECTRICITY CONDITION

Total electric power, generated from the power plants is first supplied to the national grid then to the whole country through national grid. The Padma-Jamuna-Meghna River divides power distribution system into two zones, East and West. The East contains nearly all of the country's electric generating capacity, while the West, with almost no natural resources, must import power from the East. The vast majority of Bangladesh's electricity consumption takes place in the East, with the entire region west of the Jamuna River accounting for only 22% of the total. There are many organizations to distribute electric power in whole country. Dhaka electric supply authority (DESA), Dhaka electric supply company (DESCO), Dhaka power development corporation (DPDC), rural electrification board (REB), west zone power development company limited (WZPDCL) etc. [1]

Total Generation Capacity in Public & Private Sector

Public Sector	Installed Generation Capacity (MW)
BPDB	4320
APSCL	1264
EGCB	622
NWPGCL	440
RPCL BPDB-RPCL JV	77 149
Subtotal	6,872 (54%)
Private Sector	Installed Generation Capacity(MW)
IPPs	2875
SIPPs (BPDB)	99
SIPPs (REB)	251
15 YR. Rental	167
3/5 YR. Rental	1861

[1] Md. Abu Zahed¹, Instructor (Computer Technology), Shariatpur Polytechnic Institute, Shariatpur, Bangladesh.

[2] Sujan Kumar Talukdar², Instructor (Computer Technology), Shariatpur Polytechnic Institute, Shariatpur, Bangladesh.

[3] Sazal Kumar Samadder³, Instructor (Computer), Ministry of Women & Children Affairs, DBWCTP (64 District), Jatiyo Mohila Sangstha, shariatpur, Bangladesh.

Power Import	600
Subtotal	5,853 (46%)
TOTAL	12,725

Table 1: Total generation of power in Bangladesh Installed Capacity Curve:

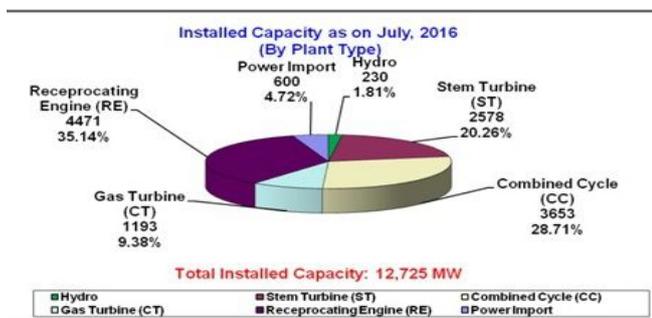
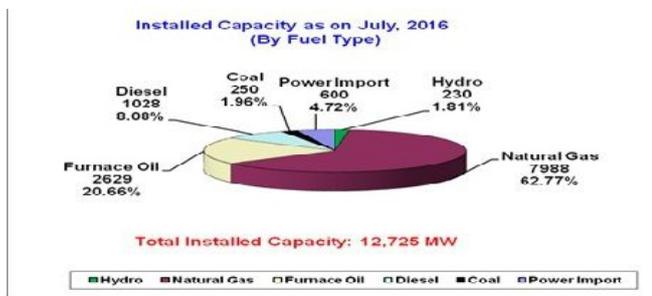


Fig 1: Total installed capacity

III. PROPOSALS

▪ New power plant installation:

Bangladesh government has already implemented many power plant using gas turbine, steam turbine, hydro energy and reciprocating engine. From which total generated power is 12,725 MW till July, 2016. But electricity demand in Bangladesh is much higher than that of. Whatever the number of plants actually built, different combinations of fossil, nuclear, or renewable plants could be built to meet the demand for new generating capacity. Congress can largely determine which kinds of plants are actually built through energy, environmental, and economic policies that influence power plant costs. Government incentives can change the relative costs of the generating technologies. For example, federal loan guarantees can turn nuclear power from a high cost technology to a relatively low cost option. The natural gas-fired combined cycle power plant, the most commonly built type of large natural gas plant, is a competitive generating technology under a wide variety of assumptions for fuel price, construction cost, government incentives, and carbon controls. This raises the possibility that power plant developers will continue to follow the pattern of the 1990s and rely heavily on natural gas plants to meet the need for new power generation. With current technology, coal-fired power plants using carbon capture equipment are an expensive source of electricity in a carbon control case.[2] Other power sources, such as wind, nuclear, geothermal, and the natural gas combined cycle plant without capture technology, currently appear to be more economical. Hence

to fulfill power crisis Bangladesh must install more power plants.

▪ Increasing capacity of old power plant:

Choice of appropriate power generation technology: technological choice, optimal economic choice, is the main factor to increase power generation in power plants. The choice of technology and fuel for power generation is obviously more complex than the mere comparison of electricity production cost for different power plant configurations. Any exercise of choosing the optimum power generation asset must take into consideration a multitude of constraints which are specific to the Project, such as:

- Fuel logistics;
- Fuel availability;
- HV network configuration;
- demand profile;
- Requirement for cogeneration (desalination, heat and steam uses for various application);[3]

To take into consideration the complexity of all technology options as well as constraints, engineering studies are typically undertaken as a sequence of studies to mitigate power crisis.

▪ Reducing system loss:

Reducing line losses in the electrical transmission and distribution system is a readily available option to enhance electrical efficiency. The flow of power across the transmission system causes power losses in the various elements of the system. Most of these power losses are a function of the square of the current flowing through the circuit or transformer windings (I^2R) and cause unwanted but inevitable heating of transmission lines, cables and transformers.[4] Since such losses are variable they are often referred to as the 'variable' power losses. At any cost system losses have to reduce to reduce power crisis.

▪ Ensuring maximum production of renewable energy basis power :

Besides fuel and coal Power can be generated using renewable energies i.e.

- ✓ Solar Energy
- ✓ Biogas Energy
- ✓ Wind Energy
- ✓ Hybrid Power System

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 convert light into electric current using the photoelectric effect. [5]



Fig 2: Power generation using Solar Energy

Solar power panel installation in roof top of buildings across the country is a running process. More than 223 KWp solar PV systems have already been implemented and about 407 KWp solar PV systems installations are under planning stages. [6] Here some implemented solar PV power plants statistics is curved in fig 2.

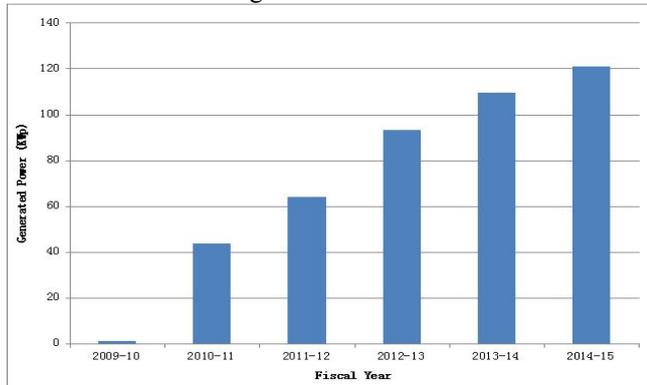


Fig 2: Solar plant implement curve

However, Government of Bangladesh should take initiatives for implementing more solar PV power plants to minimize power crisis in Bangladesh.

Biogas Energy: Bangladesh has a wonderful climate for biogas production. The ideal temperature for biogas is around 35°C. The temperature in Bangladesh usually varies from 6°C to 40°C, but the inside temperature of a biogas digester remains at 22°C -30°C, which is very near to the optimum requirement. In Bangladesh animal dung, poultry waste, and agricultural residues have long been used to produce biogas in the plant. The highly production rate of animal dung has given it more attraction to be used as the chief biomass element. But in urban areas due to the unavailability of space animal farm is not available. So the concerned have turned into alternative source of biogas. The municipal waste management could be a potential source of biogas production in the urban areas. Most of the developed countries are having adopted these municipal waste materials as their main biogas production element. [7] Bangladesh is yet to implement this municipal waste management system which could facilitate the major increase of biogas production to meet the demand of household cooking and transport fuel largely. So, using the released energy electricity can be generated by biogas plant. Fig 3 shows a biogas power plant that can generate power and generated power can be connected to the national grid.



Fig 3: Power generation using Biogas

Wind Energy: Wind energy has the potential to provide mechanical energy or electricity without generating pollutants. In Bangladesh, as in many other countries, wind energy has also been used to provide some motive force to boats with sails of various designs. Unfortunately, not much research has been conducted in these areas, although renewed interest has recently been generated in utilizing the energy of wind for wind pumps and sailing boats.[8]

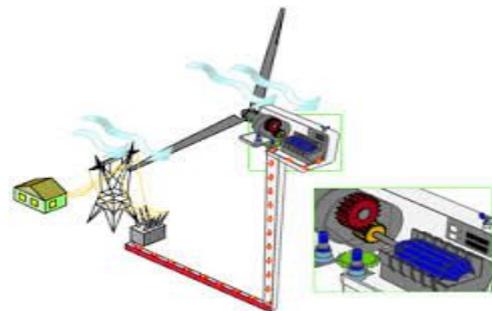


Fig 4: Power generation using Wind Energy

The potential of wind energy has not been fully explored in Bangladesh, mainly due to lack of reliable wind speed data. It appears that the wind speed will not be high but wind energy can be put to a variety of uses, especially for wind pumps, hybrid electricity generating systems with wind as one of the energy sources, small battery chargers at isolated places and electricity inputs to local grids in some coastal areas or the bay islands. [9]

Electricity generation using wind energy is confined within river sides, off-shore islands and coastal areas. BPDB installed (4×225) KW=900KW capacity grid connected wind plant at muhuri Dam of Sonagazi in Feni. Another project 1000KW wind battery Hybrid power plant at kutubdia island completed in 2008 which consists of 50 wind turbines of 20KW capacity each.

However, more wind power plants access the coastal regions of Bangladesh such as Mognamaghat of cox's bazar parky beach of anwara in Chittagong Kepupara of borguna and kuakata of potuakhali can be installed to mitigate power crisis of Bangladesh. The estimated annual energy outputs for Kutubdia and Kuakata are 133 MWh and 160 MWh for a 150 KW wind turbine; while the outputs are about 200 MWh and

230 MWh respectively from a 250 KW station at these places.

Hybrid Power System: A hybrid system might contain AC diesel generators, DC diesel generators, an AC distribution system, a DC distribution system, loads, renewable power sources (wind turbines, or photovoltaic power sources), energy storage, power converters, rotary converters, coupled diesel systems, dump loads, load management options, or a supervisory control system. Hybrid systems might also include biomass or hydroelectric generators. A schematic of the possibilities for hybrid systems is illustrated in the following figure. The operation of each of these components and the interactions between them are described in the developed DL course.

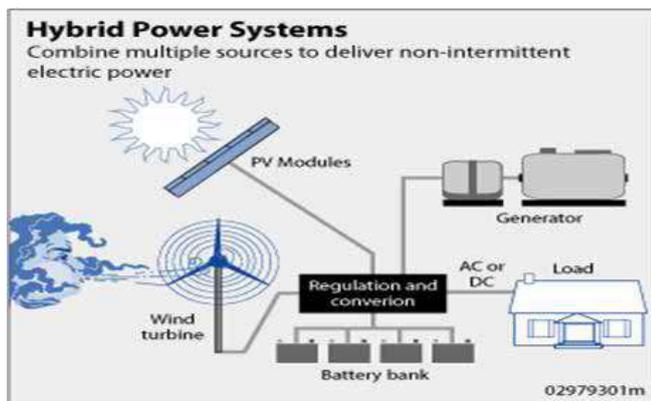


Fig 4:Hybrid Power System

Already BPDB has planned to implement 1MW off grid Solar-Diesel based hybrid power plant in Kutubdia Island. This is undoubtedly an efficient initiative to reduce power crisis. This type of projects can be installed more.

▪ Nuclear power plant installation

Bangladesh first conceived building a nuclear power plant in 1961. The Bangladesh Atomic Energy Commission was established after independence in 1973. The country currently operates a TRIGA research reactor at the Atomic Energy Research Establishment in Savar.[10]



Fig 3: Nuclear Power

More recently, in 2001 Bangladesh adopted a national Nuclear Power Action Plan.[11] On 24 June 2007, Bangladesh's government announced plans to build a nuclear

power plant to meet electricity shortages.[12] In May 2010, Bangladesh entered into a civilian nuclear agreement with the Russian Federation. It also has framework agreements for peaceful nuclear energy applications with the US, France and China.

In February 2011, Bangladesh reached an agreement with Russia to build the 2,000 megawatt (MW) Ruppur Nuclear Power Plant with two reactors, each of which will generate 1,200 MW of power. The nuclear power plant will be built at Ruppur, on the banks of the Padma River, in the Ishwardi sub district of Pabna, in the northwest of the country. The RNPP is estimated to cost up to US\$2 billion, and start operating by 2021.[13] The inter-governmental agreement (IGA) was officially signed on 2 November 2011.[14]

On 29 May 2013 Bangladesh's Prime Minister declared that a second nuclear power plant will be constructed on an inland river island in southern region of the country.[15]

▪ Inspiring non-government organization for power generation:

Recently, several small wind generators have been installed by BRAC (11 small wind turbines in various coastal sites) and Grameen Shakti (two wind generators of 300 W and 1 KW at its Chakoria Shrimp Farm). These are small DC operation type systems supplying power to target groups to improve their quality of life. Their results are not well documented. Grameen Shakti has recently installed 4 small wind generators (3x1.5KW + ONE 10 KW) in Barguna district (coastal south). They are planning to develop these stations into hybrid systems later, first with diesel and then with solar PV, to maximize the energy output and then study the cost economics. Their final quantitative results would be awaited with great interest. Besides some other private companies can come forward to implement power plant which will be greatly helpful for the development of power sector of Bangladesh.

IV. CONCLUSION

Our above mentioned information and proposals will not only remove electricity crisis but it also will gain complete socio-economic augmentation and will bring self-dependent Bangladesh. The socio-economic growth of Bengali nation will accelerate. So, it will not be a fault to keep hope that Bangladesh would be an information technology dependent country within twenty first century, if we are able to make electricity supply without load shedding.

REFERENCE

- [1] https://en.wikipedia.org/wiki/Nuclear_energy_in_Bangladesh
- [2] www.oapecorg.org/media
- [3] Organization of Arab Petroleum Exporting Countries
- [4] International Journal of Science, Engineering and Technology Research (IJSETR), A road to mitigate energy demand until 2030 & acquisition of Bangladesh in power sector from 2009 to 2013
- [5] The International Energy Agency (IEA),renewable energy coming off age

- [6] Study on renewable biogas energy production from cladodes of *Opuntia ficus indica*, ISABB Journal of Food and Agriculture Science
- [7] http://www.bpdb.gov.bd/bpdb/index.php?option=com_content&view=article&id=5&Itemid
- [8] <http://www.bpdb.gov.bd>
- [9] C. Flavin and M. H. Aeck, "The potential role of renewable energy in meeting the millennium development goals," in REN21 Network, TheWorld watch Institute
- [10] https://en.wikipedia.org/wiki/Nuclear_energy_in_Bangladesh
- [11] "Emerging Nuclear Energy Countries". World Nuclear Association. April 2009. Retrieved 2009-04-22.
- [12] "Bangladesh To Build Nuclear Power Plant". Energy Daily. 2007-06-24. Retrieved 2007-07-15.
- [13] Chowdhury, Syed Tashfin (16 March 2011). "Bangladesh signs up for nuclear power". Asia Times. Retrieved 16 August 2011.
- [14] Chowdhury, Syed Tashfin (5 November 2011). "Bangladesh, Russia sign nuclear plant deal". Asia Times. Retrieved 7 November 2011.
- [15] http://www.kalerkantho.com/?view=details&type=gold&data=news&pub_no=1258&cat_id=1&menu_id=43&news_type_id=1&index=3



Sazal Kumar Samadder achieved Masters of Computer Science & Engineering from Islamic University, Bangladesh. Bachelor of Science (Engg.) degree in Electrical and Electronic Engineering from International Business Administration & Information System University (IBAISU), Bangladesh. Diploma (Engg.) in Computer Technology, Barisal Polytechnic Institute, Bangladesh. His research interests in Electrical, Electronic, Communication, and Computer & Social Development related field.

Authors:



Md. Abu Zahed received B.Sc. and M.Sc. in Applied Physics, Electronics & Communication Engineering from Islamic University, Bangladesh. He completed his M.Sc. dissertation on communication (OFDM) and B.Sc. project on Electronics. He has several publications in international journals. His interested fields to research are Electronics and communication.



Sujan Kumar Talukdar received the Bachelor of Science (Engg.) degree in Electrical and Electronic Engineering from Pabna Science & Technology University (PSTU), Bangladesh. His research interests are in the field of Renewable energy and its Technology, Nanotechnology and Telecommunication.