

REVISITING THE CASE OF COAL-FIRED POWER PLANT IN THE CONTEXT OF BANGLADESH

Brigadier General Md Shafeenul Islam, ndc, psc

INTRODUCTION

Energy, particularly electricity and environment security are the two most soaring problems in the world today. With population growth, rapid urbanization and development, the thirst for electricity is increasing at phenomenal speed. So far, fossil fuels, especially coal, have contributed the majority share in generating electricity around the world and kept the wheel of development rolling. Since 1980, the global consumption of primary energy has doubled.¹ Increased use of fossil fuel, particularly coal has also raised the concern of the phenomenon ‘Global Warming’. World leaders are concerned to limit emission of Green House Gas (GHG) and Carbon Dioxide (CO₂) to prevent Climate Change due to Global Warming. But according to an estimate, the world energy consumption will increase 53 % from 2008 to 2035 in a business-as-usual-scenario, if no additional policy actions are taken to address energy and environmental issues.²

Bangladesh as a developing state has been gradually falling short of its economic potential because of inadequate infrastructure, particularly in the energy sector. It is trying to meet ambitious poverty reduction goals while its growing industrial, commercial, transport sectors and urban and middle-income consumers are using energy at unprecedented rates. There is a strong need for sufficient supply of energy in order to achieve the goal of poverty reduction and social development.

Energy security by and large is an association between national security and the availability of natural resources for energy consumption. Bangladesh has limited indigenous natural energy resources. Natural gas, coal, renewable energy including traditional biomass is the principal indigenous energy resources of Bangladesh. Based on the past energy and power sector development strategy, the country’s energy and power sector are currently relying heavily on indigenous natural gas. But the supply of gas is not enough to meet the ever-growing energy demand of the country. Coal which is found in five mines in Bangladesh could be another main source of energy. But Bangladesh is yet to use this source of energy because of petty politics and lack of foresightedness to develop energy sector to meet the requirement of future demand. Bangladesh needs

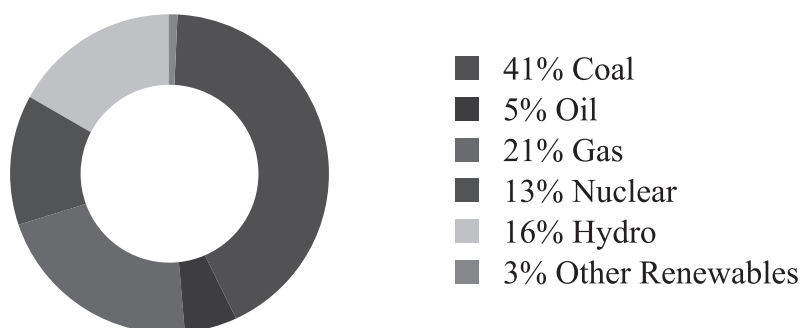
1. Economic and Social Commission for the Asia and Pacific (ESCAP), “Energy Security and Sustainable Development in Asia and the Pacific”, Bangkok: United Nations, 2008.
2. Kensuke Kanekiyo, “Energy Outlook of East Asia and Challenges for Sustainable Development”, Paper presented in the Regional Workshop on Dealing with Energy Vulnerabilities: Case Studies of Cooperation and Collaboration in East Asia, organized by RSIS Centre for Non Traditional Security (NTS) Studies on 09-10 December 2010 at Singapore.

to device an appropriate policy and strategy to use coal both imported and indigenous. Therefore, Bangladesh at present is far short of a guaranteed energy security. This article endeavours to identify the merits and demerits of CFPPs as a source of energy mix in Bangladesh through reviewing recent data and explore the applicability of CFPP as electricity source. The subject is dealt in general terms for the understanding of general readers without delving into too much technical detail on the topic.

Global Context of Coal and Electricity

Coal is a variety of solid, combustible, sedimentary, organic rocks that are composed mainly of carbon and varying amounts of other components such as hydrogen, oxygen, sulphur and moisture. Coal is formed from vegetation that has been consolidated between other rock strata and altered by the combined effects of pressure and heat over millions of years. Many different classifications of coal are used around the world, reflecting a broad range of ages, compositions and properties.³ The steam engine, fuelled primarily by coal, propelled the Industrial Revolution in Great Britain and the world around 1760. Since then coal is the driving force of economic development in developed and developing countries throughout the world. Modern life is unimaginable without electricity. It lights houses, buildings, streets, provides domestic and industrial heat, and powers most equipment used in homes, offices and machinery in factories. Improving access to electricity worldwide is critical to alleviating poverty. Despite concerns for GHG, world still now produces 41% of electricity from coal (Figure 1).⁴ In some countries, coal fuels a higher %age of electricity. For example South Africa 93%, Poland 90%, Australia 76% and Kazakhstan 70% of electricity produce from coal.⁵ It is the key fuel for generating electricity in all continents. All developed and developing countries rely on coal for stable and secure supply of electricity.

Figure 1: Total World Electricity Generation by Fuel (2009)



Source: IEA 2011

3. International Energy Agency, Available at <http://www.iea.org/topics/coal>. Accessed on 17 April 2014.

4. www.worldcoal.org

5. Abdul Muktedir, MD, Incepta Pharmaceuticals Ltd. Lecture at NDC on 29 April 2014.

Global reliance on coal is projected to continue for foreseeable future. If the current trend continues, coal consumption is projected to increase 65% by 2035. From 1990-2035, coal is projected to increase its contribution to global energy consumption between 1900 and 3200 million tonnes of oil equivalent. This demand for coal is more in the production of electricity. Over the last 40 years, coal-based electricity at the global level has increased 300% – from 2100 TWh in 1971 to approximately 8500 TWh in 2010.⁶ According to International Energy Agency (IEA) projections (Table 1), coal-based generation will need to provide even more power over the next several decades.

Table 1. Projected Incremental Sources of Electricity through 2035			
Sources of incremental electricity	2009 actual in TWh	Based on the Current Trend of Electricity Generation	
		2035 TWh	% Increase
Coal	8118	16932	109%
Gas	4299	8653	101%
Nuclear	2697	4053	50%
Hydro	3252	5144	63%
Wind	273	2005	634%
Biomass	288	1150	299%
Other	1116	1431	28%
Source: World Energy Outlook 2011.			

What the developed world started during the Industrial Revolution, many developing countries of the world namely, China and India are now doing the same with coal. They are making the best use of available coal for the development of their people and country. In fact, coal driven progress in China serves as a model for development. In 1970, over 600 million people in China lacked electricity and the GDP per capita was USD 122. To meet the growing demand for energy, China turned to its most plentiful, stable, versatile and affordable resource – coal. China utilised increased energy production, especially coal-based electricity, to catapult itself to the centre of the world's economic stage. In just 15 years (1990-2005), China provided access to electricity to over 450 million people – 1.5 times the current population of the United States. This unprecedented expansion of the electricity supply system positively affected China in its present pace of development. In China today, 97% of the population has access to electricity.⁷ In terms of absolute numbers, no nation has made more progress toward the UN Millennium Development Goals than China. Chinese coal consumption has grown from 604 Mt in 1980 to over 2800 Mt in 2008. Utilisation of its coal resource enabled China to increase electricity output fivefold from 1990 to 2008.

6. http://www.iea.org/publications/insights/insightpublications/global_value_of_coal.pdf

7. IEA, 2010

As leaders in other impoverished countries seek to utilise electricity to elevate the quality of life of their populations, many are currently turning to coal as an affordable and reliable fuel that can meet their needs. South Africa and India are proceeding with the development of coal power plants with the support of the World Bank. Developing countries including Bangladesh emit far less GHG and CO₂ than the developed countries. Considering the development of its people and their living standard as priority, they need not to worry about using coal for power generation. But, in doing so, consideration must be given to environmental protection for its own sake.

Advantages and Disadvantages of Coal-Fired Power Plant

CFPP is the oldest method of producing electricity from fossil fuel. Technology and operation of CFPP are simple. There are enough experts and scientists who specialises on CFPP which makes it easy to install and operate. CFPP has its advantages and disadvantages. Overriding advantage of it is the availability of coal at an affordable price and disadvantage is the emission of Green House Gas (GHG) including CO₂. To address the issue of GHG, research is ongoing and significant achievements have also been achieved. Carbon Capture and Storage (CCS), Underground Coal Gasification (UCG) and Ultra Super-critical CFPP are some of the latest technology in utilising coal to generate power. CCS and UCG are still in the trial phase and soon will be used commercially by many countries of the world. When these developments mature, Bangladesh may consider using it to utilise the coals that are currently not viably extractable with present technologies. Efficient CFPP emits less to near zero CO₂. Considering the environmental impacts of GHGs, all future CFPP in Bangladesh may be of Ultra Super-Critical technology.

Cost Effectiveness of Coal and CFPP

Relatively low and stable prices have contributed to coal's rising market share in recent years. This low cost structure for the coal industry provides an important buffer for world energy markets. Recent trends in world energy consumption and prices suggest that coal is playing a pivotal role in keeping energy affordable. Affordability and price stability are important reasons developing nations are turning to coal based generation.

According to studies by the European Commission, MIT, and the US Congressional Budget Office, CFPPs provide electricity at a lower cost than nuclear or gas plants.⁸ This is also confirmed by levelised generation cost studies, such as the one carried out regularly by the International Energy Agency (IEA), which takes account of all the costs over the power plant lifetime. According to IEA statistics, coal-based electricity is, on average, 7% cheaper than gas and around 19% cheaper than nuclear.⁹ IEA comparison of electricity cost from various fuel sources is given in Table 2.

8. Ecoal, January 2011, Vol. 73.

9. <http://www.ariescapitalasia.com/coal-industry/world-coal/item/15-costs-of-coal-fired-electricity>

Table 2: Comparison of Electricity Generation Costs International Studies (US\$)

	US Congressional Budget Offices 2008	European Commission 2008	EPRI 2008	House of Lords 2008	MIT 2009	Average Cost
Coal	56	59	64	82	62	65
Gas	58	72	80	78	65	70
Nuclear	73	87	73	90	84	81
Biomass	n/a	180	80	180	n/a	145
Source: IEA, Projected Costs of Generating Electricity, 2010						

Energy Security and Bangladesh

Energy security by and large is an association between national security and the availability of natural resources for energy consumption. Long term energy security is mainly linked to timely investment to supply energy in line with economic developments and environmental needs. On the other hand short term energy security is basically the ability of the energy system to react promptly to sudden changes in supply and demand.¹⁰ Bangladesh has limited indigenous natural energy resources. Natural gas, coal, renewable energy including traditional biomass is the principle indigenous energy resources of Bangladesh. Based on the past energy and power sector development strategy, the country's energy and power sector are currently relying very heavily on indigenous natural gas. But the supply of these resources is not enough to meet the ever-growing energy demand of the country. Coal could be another main source of energy, but Bangladesh is yet to device an appropriate policy for coal extraction. Therefore, Bangladesh is far short of a guaranteed energy security.

Bangladesh ranks third among the top 20 countries where people lack access to electricity. As per government statistics, 60% of its population was brought under electricity coverage by the end of 2012, against 43% in 2009. 43% of the rural inhabitants and 88 % of the urban people were under electricity coverage until 2010.¹¹ Per capita electricity consumption in Bangladesh is 259 kWh which is one of the lowest among the South Asian countries.¹² The energy consumption data of South Asia is given at Table 3.

10. Retrieved from http://www.iea.org/subjectqueries/keyresult.asp?KEYWORD_ID=4103 on 05 June 2014.

11. Hussain Ahmed, bdnews24.com. Published: 2013-05-28

12. Retrieved from http://www.nationmaster.com/graph/ene_ele_percap-energy-electricity-consumption-per-capita accessed on 29 April 2014.

Table 3: Electricity Power Consumption (kWh per capita) in South Asia					
	1971	1981	1991	2001	2011
Bangladesh	10.0	20.1	48	111	259
India	99.1	152.9	288	392	684
Nepal	6.1	14.1	39	66	106
Pakistan	89.3	140.1	288	365	449
Sri Lanka	58.3	101.2	160	293	490
Source: The World Bank Data.					

Diversification of energy supply sources is the starting point of energy security.¹³ To ensure guaranteed and uninterrupted supply of energy for next about 50 years, with the limited indigenous energy that it has, Bangladesh needs to plan and take necessary actions right from now. Besides, due importance needs to be given on renewable energy, energy efficiency as well as energy conservation.

Present State of Demand and Supply of Power in Bangladesh

Electricity is a crucial ingredient for poverty alleviation, industrial growth, and infrastructure development, quality of living standard of the people and for overall development of the economy. Bangladesh has achieved worthy growth in recent years. A booming economic growth, rapid urbanization and continuing industrialization and development have increased the country's demand for electricity. Presently about 60% of the total population has access to electricity including renewable energy. Every year the demand is increasing at a rate of 10%. Generation capacity could not be increased accordingly because of the lack of vision and efforts of successive governments in the past for the development of this sector. As a result, the country today suffers from chronic deficit and unreliable supply of electricity which is the natural consequence of years of negligence. The maximum power demand in 2012-13 fiscal years was 8349 MW.¹⁴

Total generation capacity as on August 2013 was 8,537 MW which includes 5110 MW and 3427 MW in public and private sector respectively. This makes per capita generation of 292 Kwh which is comparatively very low.¹⁵ Maximum electricity demand and peak generation during this period was 8349 MW and 6434 MW.¹⁶ It is to note that there is 1915 MW (22.43%) difference between the generation capacity and actual generation of electricity. The reasons for this lower peak generation with respect to generation capacity were : (i) some plants are out of operation for maintenance, rehabilitation and overhauling (ii) capacity of some plants derated due to aging and (iii) gas shortage. It

13. World Economic Forum, "The New Energy Security Paradigm", spring 2006, p.5.

14. Annual report of BPDB 2013.

15. <http://greeninfrabangla.com/593/>

16. Annual report of BPDB 2013.

should be noted that BPDB has nearly 25% of the power plants that are 20 years or more old and hence subject to temporary shutdown and high maintenance cost.¹⁷ Details of installed generation capacity are given at Annex C. The power generation mix by plant and fuel type in fiscal year 2012-13 is shown in Table 4 below.

Table 4: Generation Mix in FY 2012-13			
	By Type of Plant	By Type of Fuel	
Hydro	220 MW (2.58%)	Gas	5730 MW (67.12%)
Steam Turbine	2193 MW (25.69%)	Furnace Oil	1876 MW (21.97%)
Gas Turbine	1295 MW (15.17%)	Diesel	511 MW (5.99%)
Combined Cycle	1455 MW (17.04%)	Hydro	220 MW (2.58%)
Reciprocating Engine	3374 MW (39.52%)	Coal	200 MW (2.34%)
Total	8,537 MW (100 %)	Total	8,537 MW (100 %)
Source: Bangladesh Power Development Board (BPDB).			

Projected Power Demand in Bangladesh

The demand for electricity has been on the rise due to growing population and increasing economic activities. Every 1% of GDP growth is estimated to lead to a growth of 1.4% in electricity demand in a typical developing country. For a 6-7% typical annual economic growth rate, this would imply a need for close to 8-10% growth in electricity supply.¹⁸ Keeping this in view, government has prioritized the power sector as a priority development sector. In this regard, the government has set the vision to provide access to affordable and reliable electricity to all by the year 2021. The government also prepared the power sector master plan (PSMP) in 2010 keeping its focus up to 2030. This plan states that in 2030, the demand of power would be around 34,000 MW¹⁹. While the present generation capacity is only 8500 MW, it implies that considerable endeavour is required by the government to achieve the targeted goal.

Present Sources of Power in Bangladesh

Natural Gas. Major source of primary energy in Bangladesh is natural gas. It is considered as one of the driving forces of the economy of the country as three-fourths of the total commercial energy is provided by natural gas. As many as 23 gas fields have been discovered since 1955 when the first gas field was found in Sylhet. Approximately, 4-5% households of the country have natural gas supply.²⁰ In the past, in order to export

17. http://idlc.com/sector_coverage/1332567043Research%20Report%20on%20Energy%20Sector%20of%20Bangladesh-Initiation,%20Mar%2015,%2011.pdf

18. Mohammad Alauddin, MPA, Deputy Secretary Power Division, in a lecture delivered on 25th March 2014 at National Academy for Planning & Development

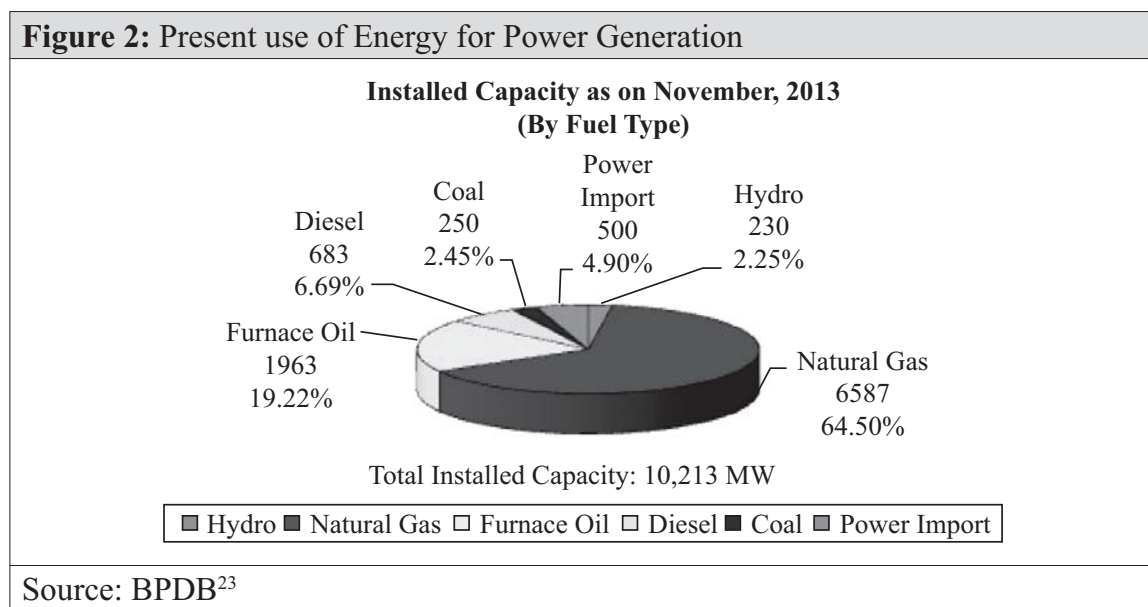
19. BPDB website. Accessed on 30 June 2014.

20. Ijaz Hossain, op cit.

gas, over-enthusiastic parties took different initiatives by exaggerating the actual reserve of natural gas. Meanwhile, exploration of new gas fields and extraction activities by the native organization, Bangladesh Petroleum Exploration & Production Company Limited (BAPEX) slowed down and the propaganda about exaggerated gas reserve created a delusion among the people. Consequently, it ultimately hindered the economic use and conservation of this valuable resource.

Present Utilization of Gas to Meet Power Needs. The existing natural gas is mainly used in electricity (42%), fertilizer (7%), industry (17%), domestic (12%), captive (16%), CNG (5%), Commercial and Tea Estate (1%), transport and housing sectors.

Over 64% of Bangladesh's power plants are now running by natural gas and the remaining 36% by hydro, coal and liquid fuel. Currently, per day about 2287 million cubic feet (mmcf) of gas is produced in the country against a demand of 2700 mmcf.²¹ As a result up to 413 mmcf supply shortfall is experienced which naturally affects the electricity generation by existing gas based power plants. Gas demand for power generation is nearly 1200 mmcf but Petrobangla can supply maximum 900 mmcf.²² During peak period, gas supply to fertilizer industries are stopped for supplying gas to the power plants. Present use of Gas vis-à-vis other energy resources for electricity production is given at Figure 2.



21. Petrobangla Annual Report, 2012.

22. Mushfiqur Rahman, Primary Energy Supply Challenges for Power, The Daily Star, 01 January 2014.

23. Retrieved from website of Bangladesh Power Development Board. Accessed on 15 April 2014.

Present Reserve and Production Levels of Natural Gas. So far, in Bangladesh as many as 69 exploration wells (13 are in the offshore and 56 are on shore) have been drilled, which resulted in discovery of 23 gas fields. Total 19 Gas fields are in operation now. The gas initially in place (GIIP) has been estimated as 27.04 trillion cubic feet (tcf) out of which estimated proven recoverable reserve is estimated at 20.70 tcf. Up to December 2012, as much as 10.92 tcf gas has been produced, leaving only 16.12 tcf of recoverable gas.²⁴ So the remaining possible reserve is likely to be 9.78 tcf which is expected to last up to 2019.²⁵ Bangladesh requires about 26 tcf additional gas by 2025 to attain 7% GDP growth.²⁶

Gas Demand vs. Forecast Production. There is a sustained and growing gap between forecast gas demand and forecast gas production. The demand and supply shortfall reaches 895 mmcf by 2014, and totals 3,726 bcf over the period 2009-2020²⁷. This is a significant shortfall, representing 22% of the already constrained forecast demand over the period. Gas sector experts believe that from 2016 the gas production in the country will gradually start to decline. In the absence of new gas discoveries followed by substantial improvement of existing fields to increase the reserve capacity, this forecast gas shortfall is likely to have a profound impact on the economy in the coming years.

Petroleum Products. Bangladesh has insignificant domestic production of petroleum products. The country has limited reserves of natural gas liquids with some potential for finding oil deposits. The exploratory activities done so far have not resulted in any significant discoveries of oil. Presently, Bangladesh meets her one fourth of energy demand by importing primary energy, mainly oil. Over the decades, the net import dependency of fuel has been decreasing but the relative amount is increasing. Transport sector, partially the agriculture and power sectors depend heavily upon imported oil. Petroleum products constitute approximately 23% of the commercial energy used in the country.²⁸ The transport sector accounts for about 50% of the consumption of oil and irrigation makes about 16%.

Cost of Imported Petroleum. All liquid fuels are actually imported. Currently, in an average, Bangladesh imports about 1.3 million tonnes of crude and 2.7 million tonnes of refined oil each year.²⁹ In 2012-2013, total quantity of crude and refined petroleum commodities and Furnace Oil imported in the country was 12,92,102 MT (metric tonnes), 28,27,160.29 MT and 8,03,603.36 MT at an import cost of 34,891.62 crore

24. Petrobangla Annual Report 2012.

25. http://idlc.com/sector_coverage/1332567043Research%20Report%20on%20Energy%20Sector%20of%20Bangladesh-Initiation,%20Mar%2015,%2011.pdf

26. Dr Abdullah Al Faruque, op cit.

27. ADB Technical Assistance Consultant's Report, "People's Republic of Bangladesh: Preparing the Gas Sector Development Program (Financed by the Japan Special Fund)", Project Number: 38164, April 2009, pp25-26.

28. Nazmul Ahsan Kalimullah, op cit.

29. Energy and Mineral Resource Division, Ministry of Power, Energy and Mineral Resources.

taka³⁰ of which one billion dollar was spent on fuel subsidy for rental power plants. This puts a heavy strain on the economy of the country and it may not be possible to continue for long. Dependence on imported oil for energy also makes the country vulnerable to increases in oil price in international market.

Renewable Energy. Hydropower, solar energy, wind turbines and bio-mass are the potential renewable energy in Bangladesh. Large scale commercial applications of renewable energy source is yet to be developed as the investment cost in it is generally higher compared to fossil fuel alternatives. Under the existing generation scenario, renewable energy has a very small share to the total generation. The present share of renewable energy is about 0.5%.³¹ The only hydroelectric power plant at Kaptai has a generation capacity of 230 MW by 7 units (3 units of 50 MW and another 4 units of 20 MW capacity). To generate electricity from wind energy, 4x225 kW = 900 kW capacity grid connected wind turbine at Muhuri dam area of Sonagazi in Feni and 50 wind turbines of 20kW capacity each (total 1000 kW) at Kutubdia island are in operation since 2008.

Coal. High quality Bituminous coal mines have been discovered at Khalashpur of Rangpur, at Boropukuria, Fhulbaria, Dighipara of Dinajpur and at Jamalganj of Bogra in the north-western zone of the country. Coal of Bangladesh is of very high quality due to its high level of heat generation capacity, low in sulfur and ash content. If initiatives are taken for exploration all over the country, there are enough possibilities to discover more coal mines. By establishing mine mouth power plant based on coal and using it in the industries as a source of energy Bangladesh can ensure the proper use of extracted indigenous coal.

Estimated Reserve of Coal. Bangladesh has around 12 identified coal basins and 5 depositors.³² In Bangladesh the current coal reserve and extractable quantity is 3,300 million tons and 1062.50 million tons ³³ respectively. As per scientific calculation, 1 TCF gas is equal to 38 million tons coal (Heating Value), thus mathematically 1062.5 million tons of coal is equal to 28 TCF gas. Extraction method of Jamalganj remains undecided due to greater depth. Barapukuria and Phulbari coal deposits are at shallower extractable depths and are suitable for open pit mining, while Khalaspir and Dhigirpar coal deposits are planned for underground mining. Open pit mining can extract 85-95% of the coal, while it is 20% with underground mining. Barapukuria has 370.50 million tons (9.75 Tcf gas value), while Phulbari has 543.40 million tons coal (14.3 Tcf gas value). At present Bangladesh consumes some 3 million tons coal/year and some 2.5 million tons coal is imported from Meghalaya, India.

30. "Bangladesh Petroleum Corporation web site", accessed on 06 May 2014.

31. BPDB Annual Report 2012-13.

32. "Asia sustainable and alternative energy program, Hydroelectricity potential, A world Bank study report", retrieved from <http://web.worldbank.org>, accessed on 06 June 2014.

33. Muinul Hasan; Domestic Coal Market; Energy and Power, June 16, 2009, p-31

Present Utilization of Coal to Meet Power Needs. At present only one underground coal mine at Barapukuria is in operation with a production capacity of 1MT/per year.³⁴ Only a small underground coal mine built in the Barapukuria basin produced for last eight years approximately 5.5 million tonnes costly coal.³⁵ The leased area for Barapukuria mine has 390 million tonnes good quality coal in-situ and major part of the reserve will have to be untouched by the existing mining methods. This mine is being used to fuel the 2x125MW CFPP at Barapukuria in Parbotipur. It is Bangladesh's first which began commercial production in March 2006. Coal mine at Barapukuria has been plagued with many problems. The project was approved in March 1992 and was to be completed in 2001. However, due to many hiccups on the way the project finally started its production on 06 September, 2005. At present it is continuing with actual production of 0.5 MT per year which is half of its designed capacity.³⁶ Private sector consumers, including brick kilns and tea gardens are consuming around 3000 tonnes of coal per day from this mine. The coal fired power plant at Boropukuria which now has de-rated capacity of nearly 160 MW, consumes only around 1200 tonnes of coal per day. Meanwhile, Government has approved plans for adding a third unit of 250 MW plant in the power plant complex.³⁷

Coal Requirement Forecast for Power Generation. Natural gas based energy may not be sustainable in Bangladesh due to inadequate reserve. So, indigenous coal developed in a sustainable manner with social and environmental safeguards, can supply a vital part of the total energy and electricity demand in the mid-to long-term future. Generally a coal based power plant takes 4-6 years for installation. Bangladesh should immediately go for commercial exploration of coal and establish mine mouth CFPP with indigenous coal. Bangladesh energy sector can use coal for considerable period of time following the calculation as under:³⁸

- i. 3.5 million tons coal produces 1000MW annually.
- ii. Proven extractable reserve of 1062.50 million tons coal can generate 1000MW electricity for 303.57 years.
- iii. Accordingly 10,000 MW electricity can be produced for 30 years.
- iv. 15,000 MW electricity can be produced for 20 years.

34. Professor M Nurul Islam, "Energy Resources & Governance Issues: Bangladesh Perspective", 25 February 2010.
35. Mushfiqur Rahman, Primary energy supply challenges for power, The Daily Star, Wednesday, January 01, 2014
36. Professor M Nurul Islam, "Energy Resources & Governance Issues: Bangladesh Perspective", 06 April 2012. www.bpatc.org.bd/handouts/Energy_Resources.ppt
37. The Financial Express, Wednesday, March 19, 2014
39. Professor Izaz Hossain in BILIA Auditorium on May 30, 2008, following the research of work published by Mr Muinul Ahsan, Mining Engineer and Former Director (Mines and Minerals), Petrobangla in his article 'Domestic Coal Market', Energy & Power, June 16, 2009.

According to above calculation, Bangladesh may be able to produce 20,000 MW of electricity from coal up to 2039. By this time if new coal mines are discovered or the existing deep coal mines are explored, then the generation may be increased further. But, even for the 1062.50 million tons proven reserve of coal, it is not certain that this amount of coal will be available for the power generation since the extraction of coal depends hugely on the extraction process.

Focus of Government of Bangladesh (GOB) on Power Sector

To achieve more than 7% projected GDP growth by 2014 and beyond, GOB has amended PSMP 2005. The PSMP 2005 was mainly based on gas with the perception that Bangladesh has abundance of gas reserve. New PSMP 2010 suggests requirement of 24000 MW and 39,000 MW³⁹ capacities in the year 2021 and 2030 to meet the increasing demand due to enhanced economic activities. The plan aims to acquire fuel composition ratio of 50% coal (30% domestic coal and 20% imported coal), natural gas 25% (including LNG), 5% liquid fuel and 20% nuclear including renewable and cross-border trade, thus prioritizes the use of domestic primary energy sources. It is to be noted that in future, coal will be an important resource as the primary energy supply in Bangladesh due to i) its price stability and lower volatility compared with oil and natural gas, ii) longer reserve production ratio compared with oil and natural gas, and iii) wide spread availability throughout the world and is expected to be supplied stably.

Own Coal Verses Imported Coal Dilemma

Gas and coal are the two most available primary sources of power in Bangladesh. While the gas reserve is waning, Government of Bangladesh appears to be in dilemma in using her indigenous coal for energy requirement. Power sector plans to generate about 10000 MW electricity from coal by 2021, twenty % of which will be from imported coal.⁴⁰ From the reports in news media of past few months it is now evident that GOB is advancing its initiative of imported coal based power plants while there is no sign to extract own coal from the mines other than Boropukuria coal mine. To establish imported coal based power plants some contracts are already signed both at government and private sector level. Government wants to turn Moheshkhali and Khulna area as the hub of coal based power plants. But opposing this move, a case is filed in High Court and proposed Rampal CFPP near Sundarban is under severe criticism for possible endangerment of this natural wonder. For imported coal government has to set up enabling coal import facilities. These facilities include dredging of rivers, development of port facilities, deep sea port and development of railway for carrying the coal. Private sector will find the challenge even more insurmountable. By a rough estimate, all these development work

39. Power Division, Ministry of Power, Energy and Mineral Resources, Government of the Peoples Republic of the Bangladesh

40. BPDB Website.

may not be possible within next 4-5 years. Besides, global economic giants China, India and even Japan may soon go for massive coal hunt from international market making it volatile and challenging. In such a scenario, it will be difficult for Bangladesh to secure assured supply of coal from Australia, South Africa and Mozambique if not impossible. Taking into account the development cost of infrastructure, if power tariff of imported coal based electricity is not more is equal to the oil based power, then the entire endeavour of the government may prove to be futile, waste of time and money.

Among the five coal fields in Bangladesh, Jamalganj coal field in Joypurhat district contains highest coal reserve. This mine is suitable for UCG method for coal extraction in the form of in-situ syngas generation.⁴¹ As UCG technology is yet to be in the process of commercialisation, development of Jamalganj coal field may be considered later when UCG method attains technological maturity. Other four coal fields namely Barapukuria, Phulbari, Khalashpir and Dighipara may be considered for development. But other than Boropukuria coal mine which too needs further development for higher amount of coal extraction, rest of the mines are still not in production. Phulbari coal mine is ready for extraction. World reputed consultants have done extensive studies for Phulbari Mine. These reports are in government's desk for nine years. If required, Government may again engage best international consultants to review all documents included in the Scheme of Development of Phulbari mines and get their opinion. Actually, because of political reasons, government hesitates in taking straight forward decision of mining own coal and using it for mine mouth power generation. With the passage of time, vested quarters are reportedly purchasing lands and manipulating documents with ulterior motives of getting huge compensations when mining would ultimately commence. A survey on land sales and purchase around the mining area will prove it. So, any delay now in commencing mining will go to the benefits of this vested group and mining will get difficult and costlier.

Using the coal for mine mouth power generation will not require transportation thus power generation from it will be much cheaper. It is evident that Bangladesh has to import coal and LNG eventually. But now, when the country is in its path to 'Middle Income' country, it cannot afford the luxury of spending most of its hard-earned foreign exchange in importing fuel for power generation, especially when much better economic option of mining our own coal and relying on it to generate mine-mouth power generation is available. Bangladesh economy cannot absorb financial impact of fuel imports (LNG and coal) for longer duration. The energy crisis will aggravate and fuel import cost will burden the economy unbearably if the government does not immediately start mining own coal.

41. Kamal Uddin, Value conversion to coal, The Financial Express, 22 Jun 2014

The Debate of Close Verses Open-Pit Mining

Fulbari coal mine has a reserve of 543.40 million tons fine coals. Initiative to extract this coal by a foreign company in 2006 by open pit method resulted in violent protests by the locals and some vested groups. The plan was aborted because it was overly ambitious on a mega scale, had poor public relation and finally led to a violent clash between people opposing the mine and law enforcers, resulting in deaths.⁴² So open pit mining got a bad reputation in the country. At that time, for political reasons, leaders of major two political parties sided with the people of the area and opposed open-pit mine. This further charged up the people's sentiments. At present one of the leaders' party is in power for last six years and they find it difficult to move away from their earlier stand considering it to be politically damaging.

Mining method is not dependent on petty politics or policy but on the geology, geophysics, rock mechanics, soil condition, coal characteristics, etc. Policy makers and experts appear confused in deciding on the method of mining own coal often citing absence of 'Coal Policy' as an excuse. If Coal Policy is the obstacle then how deals are being singed to establish imported coal based power plants? Regulations and acts with regard to environment and natural resources including water are enough to decide on the method of mining own coal. It is through open-pit mining about 90 per cent coal in place can be recovered along with other minerals that are usually found in coal mines. On completion of mining through open-pit method, 80 per cent of the mined areas can be rehabilitated to original or better state than before.⁴³ Instances of this can be found in Germany, Australia and other open-pit mining areas where open-pit mining has significantly improved life and living condition of the mining community. Open-pit mining will not cause desertification. Pumped-out water can be professionally reused to ensure pure drinking water supply for the mining community, use for all-season irrigation in mined area and part can be pumped back to aquifer. Hence all the concerns that may have confused the Government are actually unrealistic.

The shallow depth (120-500 meter) and rock mechanical nature of two mines at Phulbari and Barapukuria favour open pit mining. This has been opined through extensive studies carried out by accredited international mining consultants. Mining the coal of these two mines through applying off the shelf mining method and setting up mine mouth power plants can generate about 5000 MW power in 4-5 years.⁴⁴ Open-pit mining may also be possible partially at Kailaspur and Dighipara. Underground mining at Barapukuria may also stop after mining coal from the present phase. Future mining at Barapukuria may be done by open-pit mining for extracting most of the available coal. Mining of Khalaspeer and Dighipara must not also be delayed. The mining should be

42. Badrul Imam, Asiadehub.com, Sunday, 23 Mar 2014

43. Khondkar Abdus Saleque, Why not mine our own coal?, The Financial Express, 03 February 2012.

44. Engr. Khondkar Abdus Saleque, energy bangla, 23 February 2014, <http://www.energybangla.com/2014/02/23/21080.html>

done as soon as possible after reviewing available studies and if required, conducting new studies. Study for Coal Bed Methane (CBM) which BHP Billiton proposed in the early 1990s⁴⁵ or UCG should also start for Jamalganj mine as soon as possible.

Coal and Concern of the Environmentalists

It is a general trend in Bangladesh to oppose any new mega projects of the government related to development. The reasons are sometimes not clear and raise many questions. In 2006, environmentalists together with the local population opposed mining of Fulbari coal mines on the plea of environmental endangerment of the area. But people of Bangladesh has no previous experience of big scale mining by open-pit method and proper Environmental Impact Assessment (EIA) of the project was done by internationally acclaimed experts. Bangladesh does not also have any issues regarding probable and possible emission impacts from CFPPs. Yet, modern technology can almost attain near zero emissions if latest technologies in this field are used. There is also no previous example of negative effect of mining in Bangladesh. But yet, the protests were on the apprehension of possible air pollution, land degradation, loss of habitat and cultivable land, water shortage etc. When government shelved the plan to develop this mine, all calmed down at the cost of uncertain power future of Bangladesh.

The government's initiative for a large imported coal based power plant at Rampal near Bagerhat in the proximity of the World Heritage Sundarbans Mangrove forest has also created controversy. The initiative for another power plant at Matarbari has been challenged at court. It is true that the Rampal CFPP site is only 13-14 km away from the edge of Sundarbans but emission from the CFPP may not affect it the way it is projected. On the other hand, coal for Rampal power plant has to come by the river flowing through Sundarban. As per the plan, big ships carrying coal will anchor near Akram Point in the Sundarban and transfer their loads to smaller ships for carrying up to the power plant site. The exercise involves huge activities inside the Sundarban and requires development of some facilities that may cause unrepairable damage to the Sundarbans and its wildlife. The government has options of setting the Rampal CFPP in another location but it has no option when the question comes on possible damages to the Sundarbans and its wildlife.

Eventually, GOB will have to mine its own coal and establish more CFPPs. To make this task easy, initially small projects needs to be undertaken taking the people of the mine area onboard. Rehabilitation of the displaced people, arrangement of the lost private land, proper compensation, job opportunity, health care and education and finally environmental aspects need to be taken care of to gain the confidence and support of the people of the mined area in particular and country in general.

45. Khondkar Abdus Saleque, Why not mine our own coal? The Financial Express, 03 February 2012.

RECOMMENDATIONS

There are five recommendations that could be inferred logically with regard to CFPP and energy security of Bangladesh for the foreseeable future:

- a. The government should immediately undertake projects to mine own coal and establish mine mouth CFPPs to meet the immediate electricity requirement that is necessary for the development. Coal extraction plan consistent with the demand of the country needs to be prepared.
- b. The government should go for open-pit method of mining to be able to keep pace with the requirement of coal necessary for power generation. To do this effectively, at the beginning pilot projects may be undertaken taking into consideration all environmental, social and demographic factors and earn the confidence of the people of the mined area. Mass awareness and involvement regarding the extraction procedure of coal especially for the open extraction method need to be generated.
- c. While power generation process with own coal gets pace, the government should develop necessary infrastructure required to import coal and generate electricity from it. Side by side, extensive exploration is required to find additional hydrocarbons within the territory.
- d. All CFPPs should be based on latest technology available i.e. Ultra Super Critical Technology and be of at least, 1 GW size where possible to make the best use of available coal and minimize environmental degradation.
- e. The government may reconsider establishing CFPP at Rampal considering the public sentiment and possible damage to the Sundarbans.

CONCLUSION

The legacy of coal for the development can be traced backed from Industrial Revolution. Since then, coal is continuing to fuel the development around the world. Despite concerns for GHG, world still now produces 41% of electricity from coal. Still some country generates about 93% of its electricity from coal. Coal has been and will continue to be a major source of energy for billions of people around the world.

All developing countries of the world including the neighbours of Bangladesh except Nepal and Bhutan are increasingly using coal for their power requirement. What the developed world started during the Industrial Revolution, many developing countries of the world namely, China and India are now doing the same with coal. They are making the best use of available coal for the development of their people and country. Developing countries including Bangladesh emit far less GHG and CO₂ than the developed countries.

Considering the development of its people and their living standard as priority, they need not to worry about using coal for power generation considering its environmental hazards. But, in doing so, consideration must be given to environmental protection for its own sake.

While the entire world leans on coal and CFPP for electricity requirement, thus development; Bangladesh generates only 2.34% of its electricity requirement from coal despite having 3300 million tonnes of high quality coal in five mines. But, there is constant gap of demand and supply of electricity since past few decades which has impeded the pace of development of the country. At present, power sector has installed generation capacity about 8500 MW but the actual generation of electricity is about 30% less because of plant maintenance, derated capacity of old plants, mismanagement of power sector and most importantly, lack of gas supply. So far, Bangladesh's electricity sector is almost mono fuel dependent relying excessively on natural gas followed by furnace oil. But 60% of gas reserve in Bangladesh has already been used and remaining gas is not likely to meet the requirement of Bangladesh's prospective growth in future. Projected demand of electricity in Bangladesh by 2030 is about 34000MW which is definitely not likely to happen if the present trend of electricity generation continues. This lack of fuel diversity in power sector has endangered the energy security of the country. It is the result of years of negligence, foresight and petty politics of successive governments in the past. Bangladesh needs to diversify its energy consumption pattern immediately to ensure energy security in future. To do this, we have to go for coal energy, unless some dramatic discovery of huge hydrocarbon is made in Bay of Bengal by extensive exploration. The coal reserve of the country can meet our future demand of energy for another 20-30 years. Besides, coal mines will generate lot of employment and ensure better future for the people of the mined area. Side by side, renewable power, power efficiency and conservation need due attention of the government.

It is heartening to note that the Power Sector of Bangladesh has finally realised to come out of its gas-based mono-energy status. As per the long term plan of the government, power requirement in 2020 would be about 17500 MW, 50% of which would be generated from CFPPs. Out of this 50% coal electricity about 30% of the coal-based power (5,100 MW) would be generated by locally produced coal and the other 20% (3400 MW) by imported coal by that time. This again, reflects the hesitation and confusion of the government to use indigenous coal. To generate power from imported coal, first and foremost requirement is setting up of required facilities for coal import which needs huge investment and time. This may also inflate price of power. If coal power is not substantially lower than the price of the power generated by liquid fuel, then power generation through imported coal would be waste of efforts, time and money. Again, it is not possible to extract about 14 million tonnes of coal per year from own coal mines by following the present method and pace of mining. This leaves with the only alternative of open-pit mining of own coal mine fields and setting up of mine mouth

CFPPs. But the issue of open-pit mining in Bangladesh is politically controversial. Both the major political parties of the country showed solidarity against this method in the past. But considering the reality of electricity sector in Bangladesh, government has no alternative to develop her own coal mines and establish mine mouth CFPP to meet the increasing demand of power for development. It is understandable that Bangladesh will have to import coal for power generation at some point of time in future. By the time necessary infrastructures are prepared to import coal, CFPPs with own coal may well be supplying required power for Bangladesh. Government should shrug off the cry of the environmentalists, imbibe the people with patriotism and approach with open mind to develop own coal mines by open-pit method to extract most of the coal that lay buried. All social and environmental aspects should be taken into consideration for proving to the affected people of the mined area that this ultimately is for their betterment and bright future. Part of Boropukuria or Phulbari mine maybe taken as the test case for open pit mining. Government's plan to develop Moheshkhali as the hub of CFPP seems to be on the right track. But plan to set up CFPP at Rampal may be reconsidered considering the sentiments of majority of the people and for its possible impact on the Sundarbans. The success of transforming the power generation system of Bangladesh from a predominantly gas-based to a predominantly coal-based and ensure future energy security would depend on how efficiently the mentioned challenges are managed. The official projections of power generation will remain as wishful thinking unless the government acts fast considering the reality and hard facts.

BIBLIOGRAPHY

BOOKS

1. Beer, J. (2009), Higher Efficiency Power Generation Reduces Emissions, Massachusetts Institute of Technology (MIT), available at <http://web.mit.edu/mitei/docs/reports/beer-emissions.pdf>.
2. Barton, B. et al. (eds) "Energy Security; Managing Risk in a Dynamic Legal and Regulatory Environment", London, Oxford University Press, 2004, p.4, cited in Gawdat Bahgat, Energy Security: An Interdisciplinary Approach, John Wiley and Sons, Ltd, 2011, p.1.
3. Economic and Social Statistics of Sri Lanka 2012 pg. 58.
4. "India: Overview, Data & Analysis". U.S. Energy Information Administration. 2011.
5. James Katzer et al and MIT Coal Energy Study Advisory Committee (2007). The Future of Coal. Massachusetts Institute of Technology. ISBN 0-615-14092-0.
6. Parvez Iqbal Cheema and Maqsoodul Hasan Nuri, (ed.), "Quest for Energy Security in Asia", Islamabad: Islamabad Policy Research Institute, 2007, p.i.

LECTURES/CONFERENCES/WORKSHOP REPORTS/SYMPOSIUM

7. Abdul Muktadir, MD, Incepta Pharmaceuticals Ltd. Lecture at NDC on 29 April 2014.
8. ADB (2008), Implementing Energy Efficiency Programmes in China's Power Generation Sector: Case Study of a Recent Policy Initiative, Mandaluyong City, Philippines.
9. ADB Technical Assistance Consultant's Report, "People's Republic of Bangladesh: Preparing the Gas Sector Development Program (Financed by the Japan Special Fund)", Project Number: 38164, April 2009, pp25-26.
10. Economic and Social Commission for the Asia and Pacific (ESCAP), "Energy Security and Sustainable Development in Asia and the Pacific", Bangkok: United Nations, 2008.

PERIODICALS/JOURNAL ARTICLES/NEWSPAPERS/MAGAZINES

11. Abdul Wadud, "Shortage of Gas for Power plant: Can't We Use Liquid Fuel?" Energy and Power (fortnightly magazine), Dhaka, Vol. 8, Issue. 12, p.18.
12. Badrul Imam, Asiatradehub.com, Sunday, 23 Mar 2014.
13. ECOAL, January 2011, Vol 73.
14. Huang Oili, The Development Strategy for Coal-Fired Power Generation in China, The Corner Stone, found at <http://cornerstonemag.net/the-development-strategy-for-coal-fired-power-generation-in-china>.
15. Jay Chirs, edited by Lamar Stonecypher, Ecoal, January 2011. Vol.73
16. Kamal Uddin, Value conversion to coal, The Financial Express, 22 Jun 2014
17. Khondkar Abdus Saleque, Why not mine our own coal? The Financial Express, 03 February 2012

OFFICIAL PUBLICATIONS

18. Annual report of BPDB, 2013.
19. Annual Report of Petrobangla, 2012.
20. British Petroleum (BP), 2011; World Nuclear Association, 2010.
21. "Executive summary of month of February 2014", Central Electricity Authority, Ministry of Power, Government of India. February 2014. Retrieved 21 March 2014.
22. Energy and Mineral Resource Division, Ministry of Power, Energy and Mineral Resources.

ONLINE/INTERNET DOCUMENTS

23. Asia sustainable and alternative energy program, Hydroelectricity potential, A world Bank study report”, retrieved from <http://web.worldbank.org>
24. “Demand forecast in gas sector” at website www.petrobangla.gov.org
25. Hydropower Development in Bhutan, <http://summit.sdpi.org/contents/ppts/A6%20-%20Gem%20Tshering.pdf>
26. Khondkar Abdus Saleque, Energy Bangla, 23 February 2014, <http://www.energybangla.com/2014/02/23/21080.html>.
27. OECD/IEA World Energy Outlook 2009, retrieved from World Nuclear Association (WNA) Website, <http://world-nuclear.org/info/inf16.html>
28. Web Site of Bangladesh Petroleum Corporation.
29. Website of Bangladesh Power Development Board

Author

Brigadier General Md Shafeenul Islam, Bangladesh Army is a Course Member of NDC 2014. He was born on 02 March 1966 in Jaypurhat, Bangladesh. He joined Bangladesh Military Academy on 25 June 1984 and was commissioned on 27 June 1986 in the Corps of Infantry. He has attended several professional courses both at home and abroad. He is a graduate of Defence Services Command and Staff College, Mirpur, Bangladesh and obtained his Masters Degree in Defence Studies from National University, Bangladesh. His foreign courses include Infantry Officers Advance Course in USA, Arabic Language and Staff Course in Saudi Arabia. Brigadier General Shafeen has fine mix of three types of appointment available in the Army i.e. Command, Staff and Instructor. He commanded an Infantry Battalion, a Battle Group and an Infantry Brigade. He served as Director of Counter Intelligence Directorate at Director General of Forces Intelligence. He served as Brigade Major of an Infantry Brigade. He was instructor in the School of Infantry and Tactics, Sylhet, Senior Instructor at NCOs Academy and Directing Staff in Defence Services Command and Staff College, Mirpur. He participated in the United Nations Mission as observer in Iraq.

Brigadier General Shafeen has traveled widely around the globe that includes countries like USA, UK, Germany, Cyprus, France, Italy Switzerland, Iraq, Kuwait, UAE and Saudi Arabia. He is happily married with Shoma Islam and has one daughter and a son. Brigadier General Shafeen enjoys playing golf and takes pleasure in traveling and hunting.