

Energy Scenario of Bangladesh & Future Challenges

Mohammed Adnan Noor Abir, Md. Tauhidur Rahman

Abstract-Bangladesh is one of the most densely populated countries in the world and its economy is in the swelling condition right now. It has manpower but the main problem for increasing industries are energy crisis. Day by day the gap between demand and production is increasing as the energy consumer is increasing gradually. Bangladesh has an alarm to exhaust its all gas reserves by 2026, if there is no newly discovered gas field or reserves. What can we do if our won natural gas is fully finished! Can our economy fully depend on imported petroleum? So we need optimized solution to solve the crisis. We should reduce gas consumption for power generation by using supplementary energy source such as coal, nuclear energy and other renewable energy and for transportation using oil. We can use LP gas for households instead of pipeline gas as there are greater misuse of pipeline gas. Beside these, it is mandatory to explore new prospecting areas for gas and coal reserves. The objective of the paper is searching for smart alteration of energy consumption pattern for better future.

Index Terms— Energy crisis, Natural gas, LPG, LNG, Coal, Renewable energy.

1 INTRODUCTION

ENERGY plays the principle role in our day to day livings in household works, industries, transportation, agriculture etc. Prosperity and economic growth of a nation fully depends on its energy availability and efficient use of it. Bangladesh is an energy deficit country. So it has to import petroleum products from other countries. Beside this lack of efficient use of own energy sources increases energy crisis. Currently, demand for gas in the country has already surpassed 3,200 million cubic feet per day (MMSCFD) whereas the average supply of gas is around 2,740 MMSCFD, leaving a shortfall of about 500 MMSCFD. Daily coal production is 4000-5000 metric tons.[1] Bangladesh imported 1090940 metric tons crude oil in 2016 and 4752607 metric tons refined oil in 2016. [8] We have 11405 MW demand for electricity in peak hours but maximum electricity generation is about 9036 MW.[3] So we are facing 2369 MW electricity crisis. Main source of primary energy that used for power generation is natural gas. If we reduce gas supply for power generation the situation will be worst. Bangladesh will exhaust its gas reserves by about 2026. If it occurs energy situation will be worst. So we need to search for a solution to tackle the upcoming situation. This solution can be use of current energy sources more efficiently, search for new energy sources or importing energy from other countries. To overcome the energy crisis our government has taken some important projects. Importing of about 500 MMSCFD LNG

and establishment of Rooppur Nuclear Power Plant with 2400 MW capacity are two major projects.[4] Besides development projects, we need proper optimization for maintaining sustainable energy solution.

2 PRESENT SCENARIO

Primary energy sources of Bangladesh are Natural gas, coal, biomass, petroleum, hydro energy. Natural gas is covering about 49.2% which is about one-half of total primary energy source while biomass 34.6%, petroleum 15.6%, coal 0.4%, hydro 0.3%.[4,5]

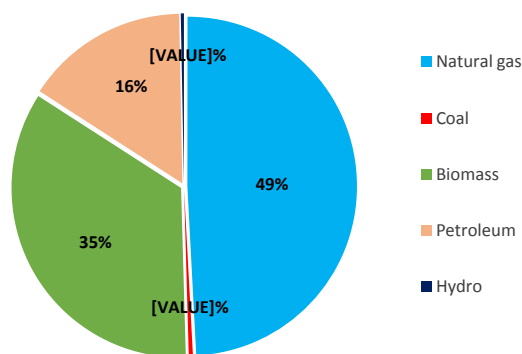


Fig. 1. Percentage of the Primary Energy Sources.

2.1 Natural Gas

Natural gas is the main energy source of Bangladesh. Natural gas is almost one-half of all primary energy used in Bangladesh. Total 26 gas fields have been discovered in this country, in which 20 gas fields are in production with 101 wells. Total initial estimated proven recoverable reserve

- Author Mohammed Adnan Noor Abir is currently pursuing B.Sc. degree in Petroleum and Mining Engineering in Chittagong University of Engineering & Technology (CUET), Chittagong-4349, Bangladesh. Email: anabir.pme@gmail.com
- Co-Author Md. Tauhidur Rahman is currently pursuing B.Sc. degree in Petroleum and Mining Engineering in Chittagong University of Engineering & Technology (CUET), Chittagong-4349, Bangladesh. Email: tauhidur.pme@gmail.com

(P1) is 20.77 TCF and the recoverable probable (P2) reserve is 6.35 TCF. About 13.52 TCF gas was produced Up to December, 2015. So there are only 13.60 TCF of recoverable gas currently. In the 2014-15 financial year, total 892.17 BCF gas was produced in the country. The major gas producing fields of the companies are: Titas Gas Field contributing 21.1%, Habiganj 9.15%, Kailashtila 2.97%, Rashidpur 2.37% and Fenchuganj 1.55%, Bibiyana 39.66%, Jalalabad 9.85%, Moulvibazar 2.28% and Bangura 4.33%. Of this production, grid power consumed about 354.8 BCF (40.44%), industry 147.7 BCF (17.10%), captive power 150.0 BCF (16.84%), fertilizer 53.8 BCF (6.13%), domestic 118.2 BCF (13.47%), CNG 42.9 (4.89%) and commercial and tea-estates together 9.5 BCF (1.1%) in financial year 2014-15.[1]

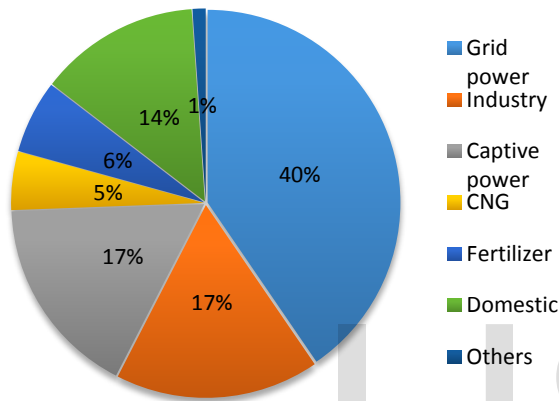


Fig. 2. Percentage of sector wise gas consumption.

2.2 Coal

Coal is one of the cheapest primary energy source in world. In Bangladesh, five coal fields have been discovered so far in the north-western part of Bangladesh with estimated reserve of more than 3 billion tones.[1] The name of these deposits are-Barapukuria coal field, Phulbari and Dighipara coal field, Khalashpir coal field and Jamalganj coal field. The five discovered coal mines with their respective reserves are given below.

Field	Depth of Coal seam (m)	Reserve (Million Metric Tons)	Percentage of total Reserve (%)
Barapukuria	118-510	390	11.81
Phulbari	150-240	572	17.33
Khalishpir	257-480	685	20.75
Dighipara	328-107	600	18.18
Jamalgong	640-1158	1053	31.90

Table 1 :Coal Reserves in Bangladesh. [2]

The first coal mine of the country at Barapukuria has been developed by Petrobangla. At present, Barapukuria coal mine is producing about 4000-5000 metric tons daily. In financial year 2014-15, total 6,75,775 metric tons of coal was produced from this mine.[1] The coal extracted from this mine is mainly used to fuel the only coal fired 250 MW power generation plant in the country located at Barapukuria. The remainder is used in brick fields, boiler industry, steel re-rolling mills etc. Bangladesh import large amount of coal every year. It imported 16,51,076 metric tons coal in 2013.[6]

2.3 Petroleum

Economy of Bangladesh greatly depends on imported petroleum. It imports crude oil, refined oil and lube oil. Eastern Refinery Limited (a subsidiary of Bangladesh Petroleum Corporation) refine Arabian Light Crude (ALC), Murban Crude and produce 16 types of marketable products including LPG, naphtha, motor gasoline, kerosene oil, jet fuel, diesel oil, furnace oil, bitumen. Present Crude Oil processing capacity of ERL is 11,29,160 metric tonnes per year. In 2015-16 ERL produced 9932 MT LPG, 12211 MT motor spirit, 13327 MT high octane blending component, 1379 MT jet fuel, 194422 MT kerosene oil, 329455 MT high speed diesel oil, 3680 MT low Sulphur diesel oil, 362719 MT furnace oil. [7] In 2016, Bangladesh imports 3130052 MT diesel, 354430 MT jet fuel, 150601 MT motor gasoline, 481673 MT furnace oil.[8] Presently 1.60 lakh tons of LP gas is imported every year. About 20,000 tons of LP gas is produced as by-products from some gas fields of Sylhet region. Yearly demand of LP gas at that time was 3 lakh metric ton.[9]

2.4 Electricity

Electrical energy is the most common form of energy as it can convert all others form of energy easily. Bangladesh have 11405 MW demand for electricity in peak hours but maximum electricity generation is about 9036 MW. According to fuel consumption the scenario is: from Natural Gas 35,822 GWh (68.633%) is produced in 2016, Hydro 962 GWh (1.844%), Furnace Oil 8,673 GWh (16.617%), Diesel 2,067 GWh (3.960%), Coal 847 GWh (1.62%),Power Import 3,822 GWh (7.32%).[3]

Now there are natural gas based power plant of 7628 MW capacity which is 61.69% of total generation capacity.[3] In financial year 14-15 power plant consumed 354.8 BCF (40.44% of total yearly production) natural gas.[1]

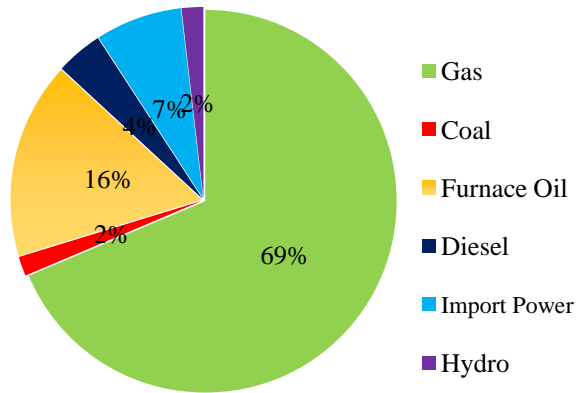


Fig. 3. Percentage share of energy used for electricity generation.

2.5 Renewable energy

Renewable energy has a very small share to the total energy now in Bangladesh. The present share of renewable energy is about 3% of total electricity generation. It includes: 1) solar power projects with about 3.61 MW capacity 2) wind power project with 900 KW capacity at Muhuri Dam area of Sonagazi in Feni and another project of 1000 KW Wind Battery Hybrid Power Plant at Kutubdia Island. 3) micro or mini hydro project in Chittagong Hill Tracts region with capacity of 50 KW.

2.6 Biomass

Bangladesh has strong potential for biomass energy. Now biomass is 34.6% of total primary energy sources. More common biomass resources available in the country are wood, rice husk, jute stick, crop residue, municipal waste, animal waste, sugarcane bagasse etc.[10] Own homestead and agricultural lands were the major source of biomass energy. Biomass energy mainly used for cooking (98.3%) in rural areas.[13]

3 CHALLENGES & SOLUTIONS

1) Bangladesh has 27.12 TCF natural gas reserves, out of which proven recoverable reserve is 20.77 TCF and the probable recoverable reserve is 6.35 TCF.[1] Year basis production of natural gas is shown in table 1.

Table 2: Yearly production rate.[1]

Year	Production (BCF)
2000-01	372.20
2001-02	391.50
2002-03	421.20
2003-04	452.80
2004-05	486.80
2005-06	527.00
2006-07	562.20
2007-08	600.90
2008-09	653.80
2009-10	703.60
2010-11	708.90
2011-12	743.70
2012-13	800.60
2013-14	820.40
2014-15	892.17

Up to December, 2015 as much as 13.52 TCF gas was produced, leaving only 13.60 TCF of recoverable gas. If we extrapolate (using exponential increment) the production rate for future, we find the following data shown in table 3.

Table 3: Yearly production rate forecast.

Year	Production (BCF)
2015-16	960
2016-17	1040
2017-18	1110
2018-19	1180
2019-20	1255
2020-21	1330
2021-22	1420
2022-23	1520
2023-24	1600
2024-25	1720
2025-26	1830

Summation of yearly production of 2015 to 2026 is 14.96

increasing use of LP gas can be helpful for our energy

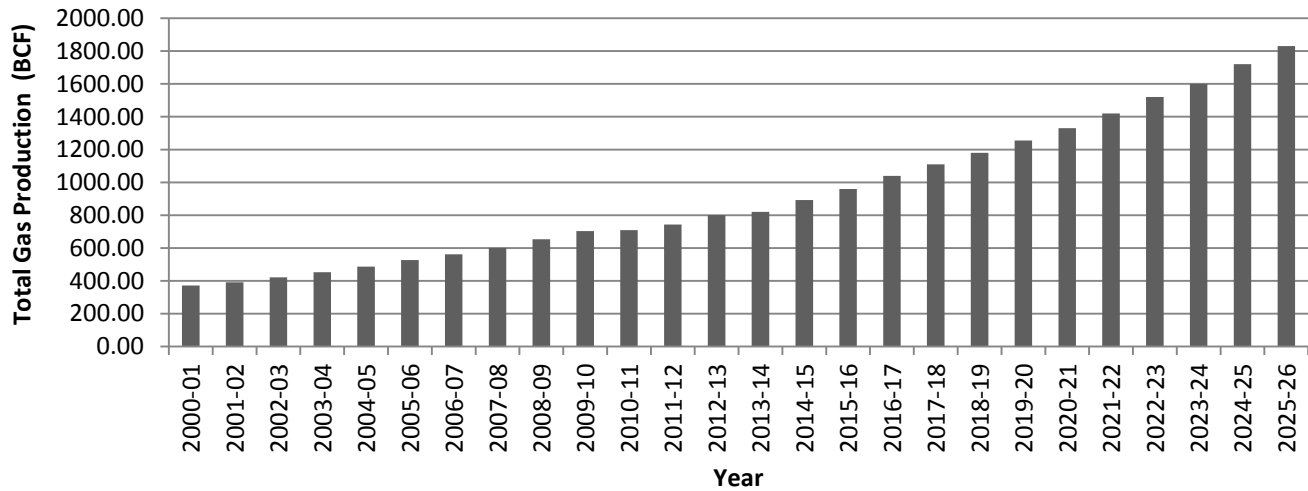


Fig. 4. Yearly natural gas production rate.

TCF, whereas our total reserve is 13.60 TCF remaining. So it is clear that Bangladesh will exhaust its natural gas reserves within 2026.

2) Recently 354 BCF (40% of yearly production) natural gas is used for generating power of 35822 MW.[1,3] But we can generate power from coal, nuclear energy, geothermal energy, solar energy efficiently. Coal is the cheapest primary energy source. Bangladesh has estimated more than 3 billion tonnes of coal from 5 coal field. Among of them only Barapukuria coal mine is in production, from which 250 MW electricity is produced. If we can bring five coal fields in production, it can play vital rule in power generation. 'Rooppur Nuclear Power Plant' is running project for producing 2400 MW electricity, which is first nuclear power plant of Bangladesh.[12] Bangladesh has no power generation from solar energy in large scale. But 6% of national electricity demand is contributed by solar energy in Germany. The overall capacity of Germany has reached 36000 MW by 2014.[11] If we cut out gas consumption for power generation we can save about 40% of our remaining reserves. By doing so, our gas reserves will remain by about 2035 instead of 2026.

3) 42.9 BCF (4.89% of yearly production) natural gas is used for CNG, which is mostly used in automobile.[1] But it can effectively run by petroleum fuel.

4) Large portion of natural gas is used for domestic purpose. About 118.2 BCF (13.47% of yearly production) used domestic purpose. But the real scenario is there are misuse of natural gas in this category. For checking this government can implement meter in gas lines. The government has stopped providing new domestic gas connections. Again LPG can be effective substitute for domestic uses. 1.80 lakh tons of LP gas is imported in the country against the demand of almost 4 lakh tons.[9] So

situation optimization.

5) Currently, demand for gas Bangladesh is about 3,200 MMSCFD, but the average supply of gas is around 2,740 MMSCFD. So there is a short of about 500 MMSCFD. Recently Bangladesh has taken a project to import Liquefied Natural Gas (LNG). Bangladesh is proceeding with a plan for setting up a Floating Storage and Re-gasification Unit (FSRU) based 500 MMSCFD of LNG import facility at Matarbari in Maheshkhali Island of Cox's Bazar district, Chittagong by 2017. In addition, Bangladesh has started initial activities to install land based LNG terminals at Moheshkhali and Paira port area with capacity of handling LNG equivalent to 1,000 MMSCFD of gas each. But unit cost of LNG is comparatively higher. Again major cost depends on international petroleum prices and its availability.

6) Bangladesh has 3300 million tons of total coal reserve from five fields. But it is unfortunate that, Barapukuria is only in operation which is only 11.81% (390 million tons) of this huge reserve. The remaining four fields which process about 88% of total coal reserves are still unexploited for our technical lacking and government unwillingness. This unexploited coal reserve is equivalent to 35TCF of gas which is twice more than the cumulative gas reserve of the country. If this huge reserve can be exploited and used for power generation than it will certainly change the energy scenario of the country. If we cut off supplying gas for power generation, it can be used for other sector which can contribute to flourish economic growth.

4 CONCLUSION

1) Gas reserves of Bangladesh is deploying very fast. So Bangladesh would likely to exhaust its gas reserves by

about 2026. If gas reserves are fully finished Bangladesh will face a great crisis.

2) There are some sectors which are fully dependent on natural gas. There are no effective substitutes for natural gas. If gas reserves are fully finished, how can natural gas is supplied to these sectors.

3) Now great portion of natural gas is used for power generation, CNG, domestic purpose. But gas consumption in these sectors can be effectively substituted by another fuel. So Bangladesh should go for it. Then it can expect longer time for deploying all the reserves.

4) Bangladesh has paid attention to LNG importing. But LNG alone cannot meet gas demand of Bangladesh. Importing LNG is more complicated and costly than equivalent crude oil or refined oil. So importing LNG can be processed an adverse effect on economy.

5) Bangladesh should pay attention on development of Phulbari and Dighipara coal field, Khalashpir coal field and Jamalganj coal field.

6) Most importantly Bangladesh should search for new gas reserves in comparatively lower probable areas.

7) Bangladesh has taken many new projects to solve energy crisis. But most importantly Bangladesh needs optimized energy use. Otherwise new projects would not be very much helpful to solve the crisis in long run.

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