

LNG or Coal: A Timely Thought Towards Future Energy Stability of Bangladesh

Md. Nahin Mahmood¹, Md. Tauhidur Rahman²

¹Lecturer, Department of Petroleum & Mining Engineering
Chittagong University of Engineering and Technology (CUET), Chittagong-4349, Bangladesh.

E-mail: nahin2582@gmail.com

²Student, Department of Petroleum & Mining Engineering
Chittagong University of Engineering and Technology (CUET), Chittagong-4349, Bangladesh.

E-mail: tauhidur.pme@gmail.com

Abstract— Energy scenario of the present world is changing rapidly. It's shifting from non-renewable energy into renewable energy. Bangladesh is not viable to shift now due to technological constraints. Natural gas is the prime energy source of Bangladesh but huge coal reserves of 3300 million metric tons are unexplored in the northern part of the country. But the gas reserve is running out and some experts forecasted that, the remaining gas of the country will be fully consumed within 2026, if no new source is discovered. So the government has decided to import LNG (Liquefied Natural Gas) for mitigating the forthcoming energy crisis. But question remains, regarding running with the imported fuel leaving more than 80% of the coal under the ground surface? We tried to draw a comparative analysis between the permanent implementations of this LNG with the proper use of the unproduced coal reserve.

Index Terms— LNG, Coal, Power Generation, Energy Stability, Energy Consumption, LNG Terminal, Coal Reserve .

1 INTRODUCTION

Bangladesh is mainly a mono fuel based country. Natural gas is the only petroleum resource that is produced by the country of its own. And it serves as the key source of energy in this country. Right from the domestic burner up to the electricity generation natural gas had a monopoly contribution till some years back. Besides, most of the industries are highly dependent on this mono-fuel; gas. So, the government started to replace some part of its use in power generation with other sources like coal, hydroelectricity etc. This is done to minimize the pressure of excessive use of gas as the reserve is declining at a high rate. But there are some sectors where it is literally tough to replace the use of gas. As the demand of gas is rapidly rising but not so of the production, so it is high time to think of the alternative ways to sustain the energy stability of the country. Considering this, the government has planned to import chilled fuel, named LNG (Liquefied Natural Gas). Hopefully, this will minimize the gas shortage of the country. But apart from this natural gas the country has a proven coal reserve of 3300 million metric tons and 85% of which are still unused. ^[1] So a healthy debate is not illogical between the importation of LNG and the usage of the unused coal reserve. So there is still a scope of thinking whether we should go for importation of LNG on a permanent basis or use this discovered but unexploited coal reserve.

2 BACKGROUND

The energy system structure of Bangladesh is mono-fuel based since its inception. Natural gas is the key source of energy in the country. Though in 1985, an oil field was discovered but it ran out producing for just 7 years with a very tiny amount of oil. Due to a favorable geological condition and extreme fa-

vorable location once it is said that, 'Bangladesh is floating on the gas-pool' which is mostly a sweet gas i.e. very little amount of sulfur present. Natural gas with possibly high percentage of sulfur is termed as 'Sour Gas'. Most of the produced gas around the world is inhibited with lots of impurities like sulfur, H₂S, naphtha etc. But the gas produced here in this Bengal basin is nearly 98% pure, which rarely needs further treatment to eliminate sulfur and thus reduce a huge processing cost. So, the use of gas started to increase with no bound. People started to use it on domestic purpose, in industry and as a fuel. The situation strengthened when most of the light and medium vehicles are started to run with compressed natural gas (CNG) replacing the old fashioned diesel engine earlier in this century. From 2001 the use of diesel based auto-rickshaw was terminated and newly imported CNG based auto-rickshaw started to play its role. Even in the early years of the century people were using natural gas randomly. But the situation started to change when we found that the amount of produced gas in the country started to fail the public demand. Scarcity of gas started in localities, providing new domestic gas transmission line was stopped for long time as the demand of industries started to reach its peak. This was the first time when people started to realize their extravagant usage of this God-gifted natural resource. The lacking of far-sightedness, increase of excessive population and public demand all are the relevant causes for this situation. So government took decision to keep the gas stations closed for a particular time in a day; generally 6 hours. Regulations also imposed on the shopping centers to be closed within 8 PM on a regular basis, as a good portion of this gas is used for power generation. The present demand of gas is nearly 3300 MMSCFD where the production is almost 2700 MMSCFD. So,

a shortfall of nearly 600 MMSCFD is existed in the country.^[2] That's why, the policymakers started to think for a newer source of energy and presently the concentration is found on importing liquefied gas from one of the gas rich country of the world and mitigate the shortage of daily gas demand by re-gasifying. Qatar, the number 1 gas exporter of the world is selected as the contributor of this chilled fuel and the re-gasifying unit will be set at Maheshkhali Island of Cox's Bazar. On a different note, coal reserve of approximately 3300 million was discovered in the country in last century. Discretely different government in different times tried to analyze the feasibility of the production of those fields with the help of different companies. But unfortunately only the Barapukuria coal field is in operation and providing a daily output of 5336.51 metric tons of coal with the help of which a thermal power plant is run with 250 MW of that coal. ^[1] But all other 4 fields are still stand still due to lack of proper planning and implications. Among this, only Phulbari field was about to start its production but due to local opposition against open pit mining, it was suspended in the year 2006.

3 WHAT IS LNG?

Liquefied Natural Gas is gas (predominantly methane, CH₄, with some mixture of ethane C₂H₆) that has been converted to liquid form for ease of storage or transport. It takes up about 1/600th the volume of natural gas in the gaseous state. ^[3] LNG is a growing popular idea around the world for its ease in transportation and better utility. But the expense of this total system leaves a second thought for the developing country. A liquefaction unit is required at the exporters end and also a re-gasification unit is needed at the importers end which needs a highly sophisticated technical expertise. ^[3]

4 LNG IMPORTATION

The search for alternative source of fuel turned into a burning issue from the very early part of this century as the remaining gas reserve will be used within next 15 years if no new giant gas reservoirs are found. So, the government started to think of the future and planned for energy stability in coming years. The first attempt was taken to re-energize the thought of using the proven coal reserve which is left for nearly 3 decades. So, the government first tried to invest on Phulbari coal field which was followed by Dighipara coal field. But none of those plans were successful for different reasons. Then many new thoughts of renewable energy, wind energy, biogas plants came into discussions and were successful in smaller scales and insufficient for the forthcoming energy crisis that has to be experienced by this growing population. As a result government has planned to stay on its mono fuel, i.e. gas by any means. The idea of importing LNG thus came into light for the first time.

In June 27 of the year 2014, a press release from the Ministry of Energy and Mineral Resource stated that, 'Excelerate Energy, a USA based company and Petrobangla have reached agreement on terms for the development and operation of Bangladesh's first LNG import terminal'. The agreement includes the provision of one of Excelerate's existing floating storage and re-gasification units (FSRU) under a 15-year long-term charter, as well as the design and construction of the installation of a subsea buoy system anchored offshore. The buoy system will act as both the mooring mechanism for the FSRU and as the conduit through which natural gas is delivered to shore through a subsea pipeline. The FSRU will have 138,000 cubic meters of LNG storage capacity and a base re-gasification capacity of 500 million standard cubic feet per day. ^[4]

In the June of the following year (2015) a new progress was highlighted when Indian company Reliance Power and Bangladesh Power Development Board signed a memorandum of understanding to develop 3,000 MW of LNG based combined cycle power project in Bangladesh which cost almost about 3 billion US\$ in phases. ^[4]

The month of May 2016 showed immense progress in importation of LNG in Bangladesh when Reliance Power has received an approval in principle from Bangladesh for the first phase of its LNG-based power plant project that includes a floating storage and re-gasification unit (FSRU). The first phase of the 750 MW power plant will be set up at Meghnaghat, around 40 km South-East of Dhaka along with the FSRU terminal at Maheshkhali Island in Cox's Bazar district of Bangladesh. The project will be developed in phases. The first phase of the project is expected to be completed in 2018-2019; Reliance Power claims it as the largest foreign investment in Bangladesh at about US\$1.3 billion. ^[4] At the same time Qatar and Bangladesh discussed broadening energy cooperation including future LNG supplies, according to a statement by Bangladesh's Ministry for Power, Energy & Mineral Resources. The first imports could start in 2018 with a 15 years contract. ^[4]

In the month of June, 2016 Bangladesh's Purchase Cabinet approved the proposal by the ministry of power, energy and mineral resources to deploy an LNG terminal as well as the government's deal with Excelerate Energy. According to local reports, Petrobangla booked 500 cubic feet gas per day for which it will be paying \$90 million per year, excluding taxes. ^[4]

By December 2016, Bangladesh announced the selection of India's Reliance Power Ltd. to build a 500,000 Mcf/d a floating storage and re-gasification unit and a 750 MW combined cycle power plant. The FSRU will be built at Maheshkhali Island and the LNG-based power plant at Meghnaghat.

naghat; the power plant on a build, own and operate basis for around 22 years with 15 years tax-holiday. In the mid-December of 2016, Excelerate Energy has announced that it has completed the necessary geotechnical and geophysical studies for the Moheshkhali floating LNG terminal in Bangladesh. This follows the execution of definitive agreements with Petrobangla earlier in 2016.^[4]

In January 2017, Summit Group has signed an initial contract with Petrobangla to set up a liquefied natural gas terminal on Moheshkhali Island in Cox's Bazar at a cost of about \$500 million. The floating terminal will supply 500 million cubic feet of natural gas per day. The LNG will cost the government \$0.45 per 1,000 cubic feet of natural gas. Summit will transfer the facilities to Petrobangla after operating it for 15 years. This is the third LNG-related agreement the government has signed so far.

In December, Petrobangla signed an initial agreement with India's energy company Petronet to set up an LNG regasification terminal on Kutubdia Island and a pipeline at an estimated cost of \$950 million. In July, the state-run corporation and US-based Excelerate Energy signed the final deals to set up Bangladesh's first LNG terminal, which will handle imported LNG and supply it to the national grid from early 2018. As Bangladesh is looking outside to ease its energy shortage largely caused by depleting domestic reserves and rising demand, the government aims to set up four land-based LNG terminals and one or two floating storage and regasification units.^[5]

5 COAL SCENARIO

Coal is a valuable natural resource. Coal, a fossil fuel, is the largest source of energy for the generation of electricity around the globe. Coal-fired power plants currently fuel 41% of global electricity. Besides natural gas, Bangladesh has significant coal reserve. Coal reserves of about nearly 3300 million tons comprising 5 deposits at depths of 118-1158 meters have been discovered so far in the north-western part of Bangladesh. The name of these deposits are-Barapukuria, Phulbari and Dighipara coal field in Dinajpur district, Khalashpir in Rangpur district and Jamalgonj in Joypurhat district. Out of which 4 deposits (118-509 meters) are extractable at present. As an alternative fuel to natural gas, coal can be extensively used in power generation. The depth of Jamalgonj coal deposit is 640-1158 meter with 1053 Million Tones in-situ coal reserve where production may not be viable by present day's technology due to the depth of the deposits. Technology of Coal Bed Methane (CBM) can be a possible option here. But after a feasibility analysis it is recently rejected as the methane content is not enough economic. So far, only Barapukuria coal field is

under production. Dinajpur Barapukuria coal fired power plant is country's first coal based power plant which capacity is 250MW.^[6]

Bangladesh is sleeping on coal mine bed located in the northern districts of Rangpur and Dinajpur, while facing a mounting energy crisis and relies on natural gas as the main source of energy, which is depleting at geometrical progression. The depth of the discovered fields ranges between 119 – 506 meters and 150 – 240 meters in Barapukuria and Phulbari respectively. The depth of the largest field at Jamalgonj ranges from 600 – 1000 meters. The area covered by coal fields is rather limited and is about 70 – 80 square kilometers. A total of 1.73 million tonnes of coal has been extracted by underground method from Barapukuria up to December 2008. The average present value of coal per tonne in international market is US\$ 52. The total value of coal will be more than US\$ 500 billion.^[6]

The five discovered coal mines with their respective reserves are in below-

TABLE1:
Coal Reserves in Bangladesh.^[1]

Field	Depth of Coal seam (m)	Reserve (Million Metric Tons)	Percentage On Total Reserve
Barapukuria	118-510	390	11.81%
Phulbari	150-240	572	17.33%
Khalishpir	257-480	685	20.75%
Dighipara	328-407	600	18.18%
Jamalgonj	640-1158	1053	31.90%

Bangladesh has 15 TCF (trillion cubic feet) of proven reserve of natural gas; the remaining 6 TCF reserve of natural gas may run out soon, if no discovery is made. As against this, the coal reserves in five fields of Bangladesh are estimated at 3000 million tonnes equivalent to 67 TCF of gas, which can conveniently serve the energy needs of Bangladesh for 50 years.^[6]

6 PRESENT STATUS OF THE COAL FIELDS

Barapukuria Coal Field- Barapukuria coalfield is located at the Parbatipur Upazila of Dinajpur district. The estimated resource of the coalfield is 390 million metric tonnes. This is the only coal field which is currently in production with a capacity of 1 million ton/ year. A thermal power plant of 250 MW is running with it.^[6]

Phulbari Coal Field- Phulbari coalfield was discovered in 1997 by BHP Minerals. The Phulbari coalfield is located about 10 km south of the Barapukuria coal field. The mining area in the Phulbari Basin covers an area of eight kilometers (north-south) by three kilometers (east-west) with coal seam(s) varying between 15-70 meters thick at some 150-270 meters beneath the surface, with average combined thickness of 38 meters. The Phulbari coal is high volatile bituminous coal. It has low ash (average 15%) and low sulfur content (<1%) and therefore suitable for both power generation and for producing semi-soft coking coal. ^[1]

Asia Energy submitted Scheme of Development on October 2005 to the Government with a plan to develop the Phulbari coal deposit by the open cut mining method. But it was suspended due to local opposition against open pit mining. The mine is estimated to produce 15 million tonnes of coal per year over 35 years of mine life. Asia Energy has also submitted proposal to setup up to 1000 MW mine mouth coal-fired power plant based on Phulbari coal. But none of those projects came into light.

Jamalganj Coal Field- Jamalganj coalfield is located in Joypurhat district. The coalfield was discovered in 1962 by the Geological Survey (of the then Pakistan) under the UN sponsored coal exploration program. The coal field has an estimated resource of 1053 Mt bituminous coal. Following the discovery of the coalfield, several international consultants, were invited to conduct mine feasibility study. Although rated technically feasible, the economic feasibility of mining Jamalganj coal could not be shown because of the unfavorable depth of coal seams. Eventually, the idea of mining coal from Jamalganj field was abandoned when a large coal deposit was discovered at much shallower depth of about 120 meter below the surface at Barapukuria basin in Dinajpur district. However, developing coal bed methane (CBM) in the Jamalganj coalfield has since been considered a potentially viable option. On June 2016, state-owned Petrobangla appointed Indian consulting firm Mining Associates Pvt. Ltd. (MAPL) to assess the methane reserve in the coal mine. The company started its quest on January 5th 2016. Their report says that the field has extremely low reserves of CBM and extracting it would be financially unviable. MAPL recommended for conducting further feasibility studies to explore potentials for underground mining in the coal field. ^[7]

Khalashpir Coal Field- Khalashpir coalfield is located in Pirganj Upazila of Rangpur district. Khalashpir coalfield was discovered in 1989 by the Geological Survey of Bangladesh. The coal was encountered at depths ranging from 257 to 482 meter below the surface in a Gondwana basin. The Khalashpir coalfield has an estimated resource varying from 685 million metric tonnes. ^[1]

Dighipara Coal Field- Dighipara coalfield is located in Dighipara Upazila of Rangpur district, Dighipara coalfield was discovered in 1995 by the Geological Survey of Bangladesh. The coal was encountered at depths is 327meter below the surface. The Dighipara coalfield has an estimated resource of 600 million metric tonnes. ^[1]

Of the 5 discovered coal mines the Jamalgonj coal is at greater depth which cannot be mined in traditional mining methods. Coal at Khalaspir and Dighipara are also at relatively greater depth. Barapukuria and Phulbari coal are at relative shallower depth. The geology makes these ideal for open pit surface mining which is in practice in the following countries now.

7 COAL OR LNG?

Bangladesh is going to face huge energy crisis in near future if no proper steps are taken. There evolves a new prospect of finding gas at offshore after the win of Sea-border dispute against Myanmar, but the uncertainty remains. There are 23 gas fields presently active in Bangladesh producing 2700MMSCFD gas. Among this huge portion almost 37.9% are used for power generation which shares more than 82% of total power generation. Still Bangladesh has a daily gas demand of 3300MMSCFD, which shows that daily 600 MMCF shortage is prevailing in the country. To mitigate this problem the present government has taken steps to import LNG which will contribute with 500MMSCFD gas to the national grid. This is certainly a timely step taken by the policymaker to reduce the shortage and for sustainable energy stability. Certainly this importation of LNG will mitigate the gas shortage but will it be an enough solution for energy stability? That is the question to be thought. Isn't it enough to shifting our energy policy to a new street by reducing the usage of our only own natural resource, gas? I think, still there are some scopes for second thought.

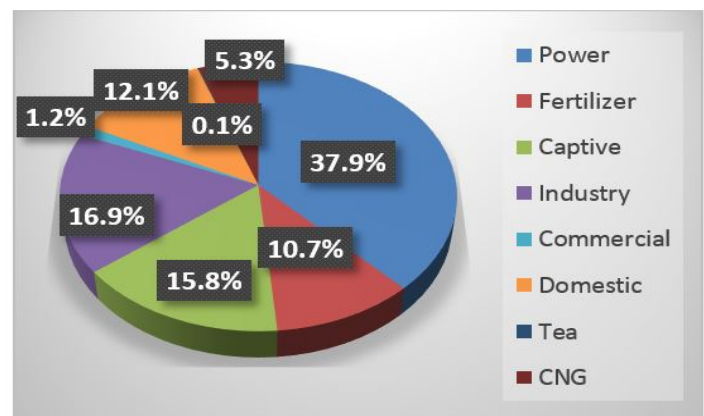


Fig.1: Gas usage in different sectors of Bangladesh

If the huge proportion of natural gas (37.9%) used in power generation is substituted by any other fuel than it will be great breakthrough for the whole energy scenario of the country. By any other fuel, we tried to mean about coal which holds a large proportion of our natural resource and still unexploited. The reserve of 3300 million tons coal reserve is not a negligible one. But it is unfortunate that, we have access to only 11.81% of this huge reserve (Barapukuria is only in operation, which has a reserve of 390 million tons). The remaining 88% coal reserves are still unexplored for our technical lacking and proper planning. If half of this huge reserve can be exploited and used for power generation than it will certainly change the energy scenario of the country. On the other hand, the gas presently using in power generation will be provided in industrial and other sectors.

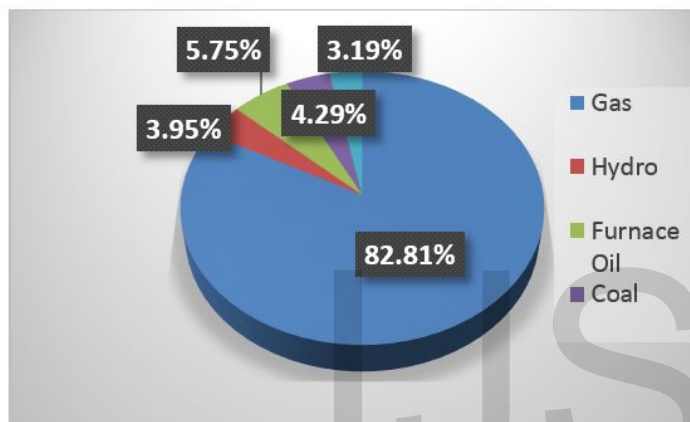


Fig. 2: Contributors in Power Generation

Now, let's see what the present energy situation of the country looks like; The Present Installed electricity capacity of Bangladesh is 15379 MW. The maximum demand of electricity is 8267 MW (up to 18 April 2017).^[2] Electricity produced from gas is 8267 MW (almost 82.81%) and from coal it is almost 4.29% of total power generation. Barapukuria Coal Field has a daily output 5336.51 metric tons. A thermal power plant is run with 2246 metric tons of coal from it producing 250 MW. A normal calculation shows that, if the whole remaining coal reserve of the country can be exploited and fully used for electricity generation, it will be equivalent to 67 TCF of gas. It is surprising that the total gas reserve recorded in Bangladesh so far is 15 TCF! So the coal reserve can contribute 4 times more than this gas reserve contributed so far. Though it is a theoretical study but it can be said without confusion that, the full or even the half of the utilization of this dormant coal reserve can effectively change the energy status. But the challenge lies in the efficient use of this huge coal reserve.

Besides, the present price of power generation using coal is 3.7 Tk per Unit whereas by using gas the price is 4.2 Tk per unit.^[6] That means a savings of 0.50 Tk can be achieved in per unit power generation.^[6] But it is true that, the installation

cost of coal based power plant is huge compared to the gas based plant. But we have to keep it in mind that, this is the capital cost and it is done once only and proper maintenance can make it worthy to be set. In a rough calculation we can see in the light of present context that, the coal based power plant can save 4133500 Tk daily by shifting from gas based plant (electricity produced from gas is 8267 MW and coal based power plant can save 0.50 Tk per KWH). And within 2 years it can save more than 300 crores taka. Though it's not enough, but this saved amount can be utilized for this shifting procedure.

The imported LNG is also costing much from us as we don't have sufficient infrastructure and previous experience of importing chilled fuel. LNG estimated installation cost is 950 million \$. Government will pay 90 million \$ per year for 15 years project. So total cost = $(950 + 90 \times 15) = 2300$ million \$. From this huge investment we will get just 500MMSCF gas daily just to cover up the shortage. But the coal reserve equivalent to 67 TCF will run for minimum 30 years from now with growing demand of the country. The calculation shows that, it can contribute with the fuel equivalent to 6118 MMSCFD of gas and early consumption of 2.23 TCF can be available. This is almost double of the present gas demand of the country (present gas demand- 3300MMSCFD). So, it is seen that, coal will produce 12 times more usable energy than LNG.

The Installation cost of Barapukuria Coal field is 194 million \$. But as the other fields are not developed yet, so it can't give an exact idea about the economic sketch. But as Phulbari, Khalashpir, Dighipara gas fields holds a proven reserve of 1857 million tons which is 57% of the total coal reserve, so it can be a good option to go for production their by framing a common 'Coal Regulation'. The depths of all the potential coal seams are within 500 meters for all the three fields, which is viable for underground mining. This produced coal will give energy equivalent to 35TCF of gas which is twice more than the cumulative gas reserve of the country. As there lies technical constraints regarding Jamalganj coal field, so we should keep this one apart and can plan for the mentioned three fields. And side by side the new options for Jamalgonj coal field needs to be sort out as CBM method is not viable here. If we think the development and production of those three fields cost nearly 2500 million\$, but it will still provide more equivalent energy than the imported LNG and the longevity will certainly be more.

Though the government started to think of coal based power plant in different parts of the country. But most of them are based on the imported coals from our neighboring country. The imported coal-based power generally costs about Tk 5.4/kwh (\$0.077) at current coal prices, which is almost 1.5 Tk more in per unit. The cost is also 1.2 Tk per unit more than the gas generated electricity.^[6] So, the utilization of coal reserve can also reduce the cost of this coal based power plant.

8 RECOMMENDATIONS

By analyzing the whole context of the country and keeping the thought of growing demand of this huge population, some recommendations can be suggested:

- * Phulbari, Khalashpir, Dighipara Coal fields should be developed quickly and taken into production as soon as possible.
 - * Alternative technique, probably a modern underground mining should be adopted for Jamalgonj Coal Field with the suggestions of experts.
 - * Gas based power plants are replaced with coal based power plant within a 5 years' time frame.
 - * Coal should be the key source of power generation; increasing its percentage of 4.2% to 82%.
 - * 37.9% of gas used in power plants will be shifted in industrial purpose within next 5 years by replacing the lion's share of the power generation with coal.
 - * Coal will serve as the key source of power generation for next 25-30 years. And within this time shifting towards renewable energy will be the prime concern.
 - * LNG can be imported for a shorter space of time. It will be implied as long as the coal fields are ready for production. A correction in the contract regarding the time length demands a thought.
 - * LNG will be a temporary solution not permanent. And least concern should be given to any new LNG project.
- These recommendations demand further scrutiny. The prime target of this is to sustain the availability of the gas as long as possible. According to many experts, we have a frontier of gas usage with the present production up to 2026-30. But the aim should be to extend it at least 15 years more.

9 EFFECTS

The above discussed recommendations will be followed by certain effects in both the social and economical sectors of Bangladesh. There are scopes for alteration in the present economic structure of the country by adopting proper coal policy and its subsequent implementation. Let's look at the prospective effects that may cause due to the proper using of coal:

1. Among 2700 MMCFD gas produced in the country almost 1100 MMCFD (37.9%) is used for power generation so this will reduce the dependency on gas.
2. Among the demand of 3300 MMCFD gas the demand will reduce to 2200 MMCFD. So 500 MMCFD gas will be surplus and can be used in industry.
3. Industry will flourish more.
4. People will be employed in newer industry.
5. GDP will grow, per capita income will rise.
6. Cost of electricity rise won't affect much.
7. As coal can produce more electricity, so more new areas will come under the light of electricity.
8. Usage of coal will reduce the energy dependency on import

(LNG).

9. Proper use of coal reserve.

10 CONCLUSION

Power Crisis has been a long clamor in Bangladesh and this seems to persist for the coming decade or so. Beyond optimistic illusions, facts and realities are too fierce to be accepted. Energy infrastructure of Bangladesh is quite small and insufficient but the demand is very high. The per capita energy consumption in Bangladesh is one of the lowest (136 kWh) in the world. Electricity is the major source of power for country's most of the economic activities. So importance can't be denied. In our country we have few coal pits and the quality of our coal is quite rich and it can be used easily to produce Electricity. Growing economies always need a proportional need for power. The planned undertaken by government of importing LNG must be a good timely initiative but it shouldn't be a permanent one. The huge coal reserves demand utilization for the sake of our energy stability. Earlier, different discrete projects were taken by the policymakers to produce coal but no firm regulations and plan was there. As the energy crisis is inevitable, so we don't have any other options but turn back. Coal could be a vital weapon to challenge the forthcoming energy hunger in near future. So it is a hope that, the law and policymakers will make it count by proper scrutinizing and establish the energy stability of the country.

11 REFERENCES

- [1] Dr. Badrul Imam, *Energy Resources of Bangladesh*, 2nd Edition, 2012.
- [2] <http://www.bpdb.gov.bd/bpdb/index.php> (26 June 2017).
- [3] <https://en.wikipedia.org/wiki/LNG> (5 July, 2017).
- [4] <http://www.lngworldnews.com/> (20 June 2017).
- [5] <http://www.thedailystar.net/business/> (20 June, 2017)
- [6] <https://mygoldenbengal.wordpress.com/2014/02/14/> (2 June, 2017).
- [7] <https://energybangla.com/> (23 June, 2017).