

Energy Scenario

Bangladesh

2018-19



Hydrocarbon Unit
Energy and Mineral Resources Division
Ministry of Power, Energy and Mineral Resources

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P r e f a c e

Report on Energy Scenario, Bangladesh was prepared and published by Hydrocarbon Unit for the first time in October 2009. The present one is the issue of Energy Scenario, Bangladesh for the period of July 2018 to June 2019. In this report, Energy Scenario of Bangladesh has been reflected. Daily average gas production rate have been included in the report as well. Moreover, Share of Primary and Commercial energy, Sector-wise Liquid fuel consumption, Historical Gas production and Net Energy Generation along with the graphical presentation have been depicted.

This report has been prepared based on the data available from the Monthly Reserve and Gas Production Report of HCU and Monthly Information System (MIS) of Petrobangla. Bangladesh Petroleum Corporation (BPC), Bangladesh Power Development Board (BPDB).

It is expected that the report will be helpful as reference book and elements of interest for the concerned.

The report will also be available at HCU's website: www.hcu.org.bd.

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1.0 Introduction

Bangladesh is a mid-income country. Her GDP growth rate is one of the world's largest. For any country, development is the precondition for continued growth of GDP. And the main driving force of the country's development is energy. Proper use of energy is essential to meet the country's growing energy demands as well as to lift up from a mid-income country to a developed country. Energy is playing a vital role in implementing Vision-2121, Vision-2041 and achieving Sustainable Development Goals.

In Bangladesh, about 63 percent of energy demand is met from natural gas. Among other fuels- oil, coal, biomass etc. are vital. There is a huge reserve of coal in our country, but coal is less produced as well as less used here. On the other hand, natural gas reserve is not that substantial, but its production and consumption are the highest among the available resources. Besides those, energy demand is being met through imported oil and LPG. Moreover, the government has already started importing LNG to meet increasing gas demand. Biomass is being used as a lion's share of energy. The energy demand is also being met by importing electricity from India.

The use of renewable energy instead of gas, coal and oil has been started in the whole world and is essential for sustainable development and keeping up with the environment by preventing carbon emissions. Many countries in the world like Sweden, Germany, China and USA are currently using renewable energy as a significant part of their energy demand. Bangladesh is also using renewable energy, but it's very less than necessity. The government has taken various steps to increase the use of renewable energy in the future, including solar home system, solar irrigation system, Rooppur nuclear project, etc.

Development of energy sector is the key factor for continued development of the country. Bangladesh needs to emphasize on the new exploration activities using latest techniques to explore new mines. Apart from reducing dependence on natural gas, it needs to be coordinated with the imported LNG and enhance the percentage of usage oil and LPG; thereby Bangladesh will succeed in reaching its desired goal of development.

2.0 Current Position of Energy Resources

Known commercial energy resources in Bangladesh include indigenous natural gas, coal, imported oil, LPG, imported LNG, imported electricity and hydro-electricity. Biomass accounts for about 27% of the primary energy and the rest 73% is being met by commercial energy. Natural gas accounts for about 63% of the commercial energy (with 7% imported LNG). Imported oil accounts for the lion's share of the rest. In this year Bangladesh imports about 8.6 million metric ton of crude and refined Petroleum Products. Apart from natural gas and crude oil, coal is mainly used as fuel in the brick-fields and Thermal Power Plant.

Moreover, power is also being generated by using Solar Home System (SHS) in on-grid and off grid areas. The amount of power generation using solar system is currently about 368 MW. In addition there are some poultry and dairy farms in which bio-gas plants are being set up and this bio-gas is used for cooking and power generation. The amount of power generation from such plants is currently about 1 MW. Steps have been taken to generate electricity by Bio-Mass Gasification Method in the country.

Estimated final consumption of total energy is around 55 MTOE. Average increase of energy consumption is about 6% per annum. Per capita consumption of energy in Bangladesh is on an average 344 kgoe (Kilogram Oil Equivalent) and per capita generation of electricity is 510 kWh with an access to electricity 95%, which is lower than those of South Asian neighboring countries.

Table 1: Energy calculation for 2018-19. (MTOE)

Name	Unit	Mtoe
Oil (Crude + Refined) in K ton	8650	8.65
LPG in K ton	699	0.70
Natural Gas in Bcf	964.77	22.37
LNG in Bcf	115.89	2.69
Coal (Imported) in K ton	5754	3.64
Coal (Local) in K ton	803	0.51
RE (Hydro) in MW	230	0.17
RE (Solar) in MW	368	0.27
Electricity (Imported) in MW	1160	0.86
Total Commercial Energy		39.85
Biomass		14.75
Total Primary Energy		54.60

Figure 1: Share of Total Primary Energy (2018-19)

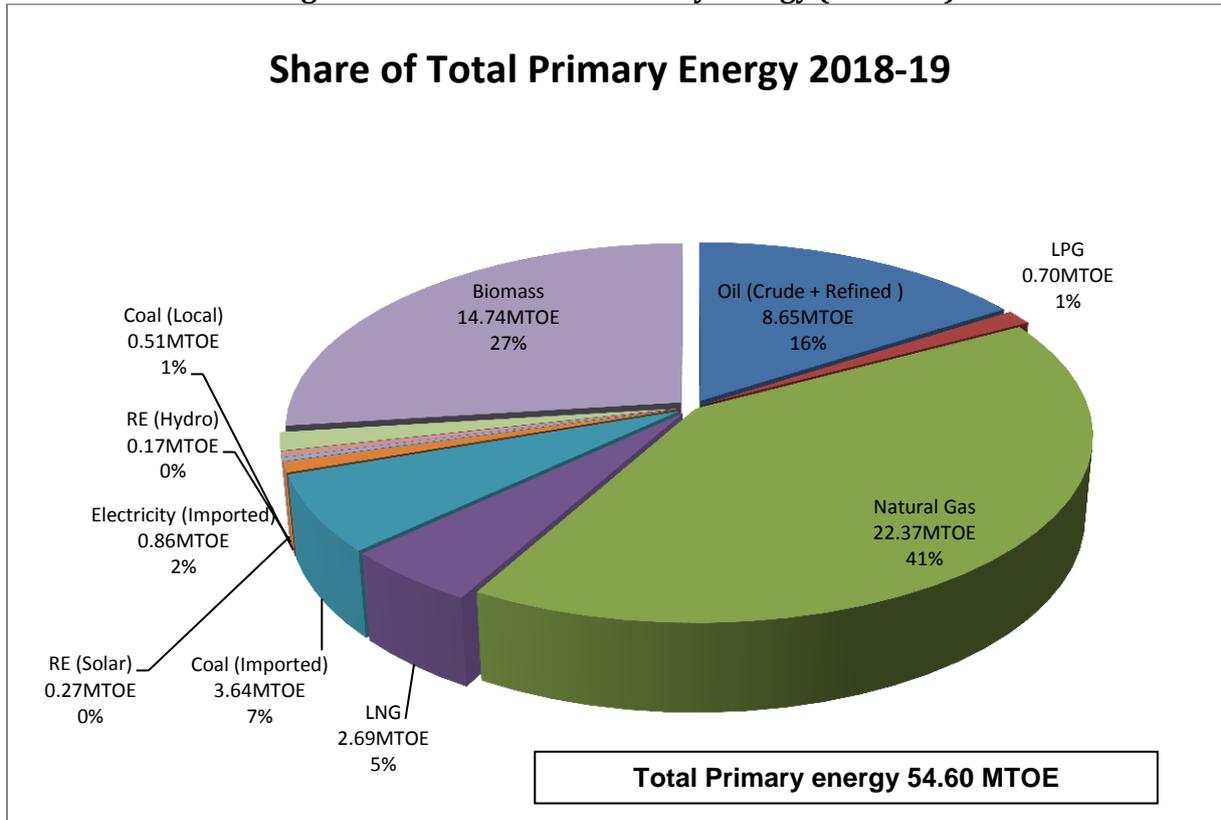
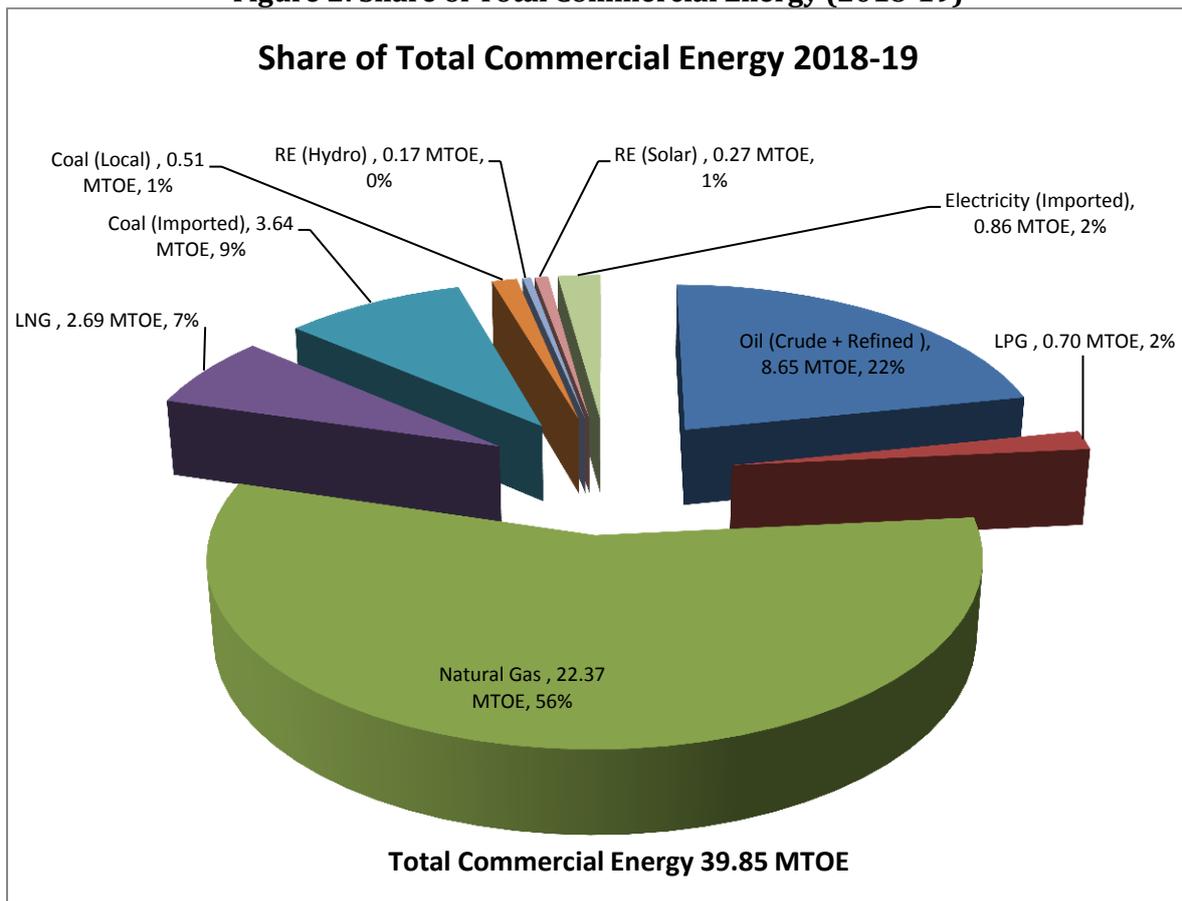


Figure 2: Share of Total Commercial Energy (2018-19)



Bangladesh also has a bright potential to produce electricity from wind and mini-hydro. Recently, solar power based irrigation pump has been used in a number of areas of the country. Its wide use will lessen the pressure on diesel and electricity.

3.0 Natural Gas

3.1 Organizational Structure

Bangladesh Oil, Gas, and Mineral Corporation, short named Petrobangla, under the Energy and Mineral Resources Division of the Ministry of Power, Energy and Mineral Resources is entrusted with the responsibility of exploration of oil and gas, and production, transmission and marketing of natural gas in the country.

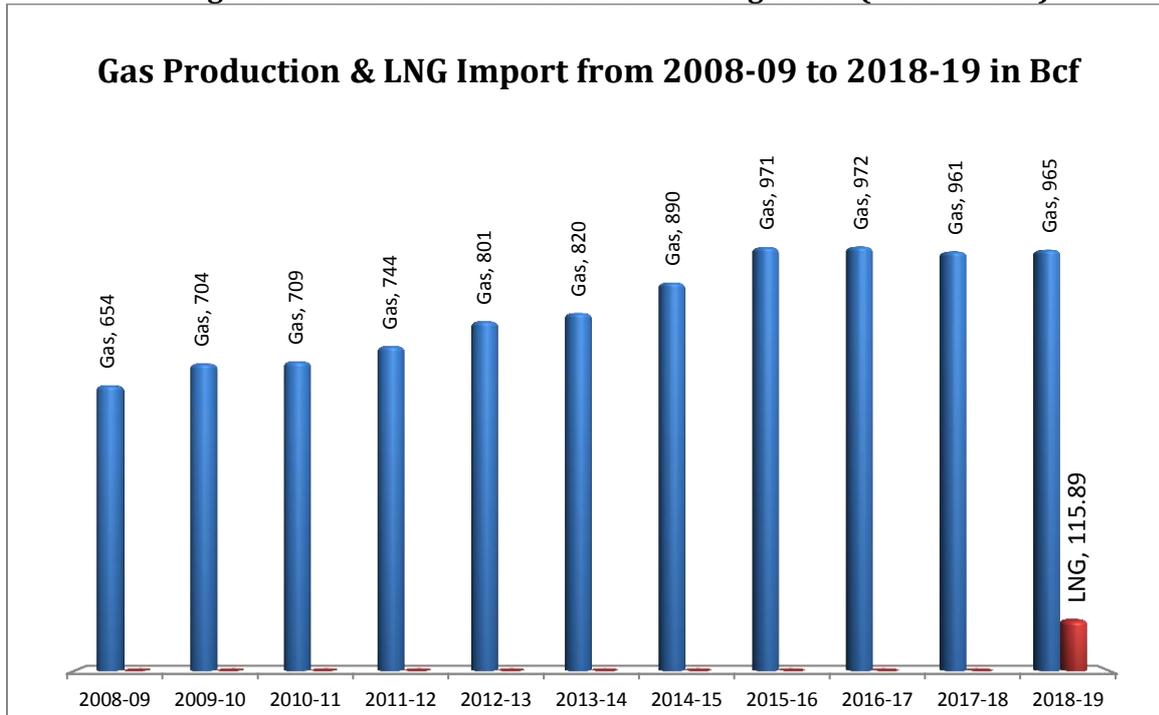
3.2 Natural Gas Reserve

Since first discovery in 1955 as of today 27 gas fields, 25 in the onshore and 2 in the offshore have been discovered in the country. Of them 20 gas fields are in production, one offshore gas field have depilated after 14 years of production while other offshore field has not been viable for production due to small reserve. The estimated proven plus probable recoverable reserve was 28.69 Tcf. As of June 2019, a total of 16.93 Tcf gas has already been produced leaving only 11.76 TCF recoverable reserve in proven plus probable category. Some key information about the natural gas sector is presented in the Table 2.

Table 2: Natural Gas Sector at a Glance

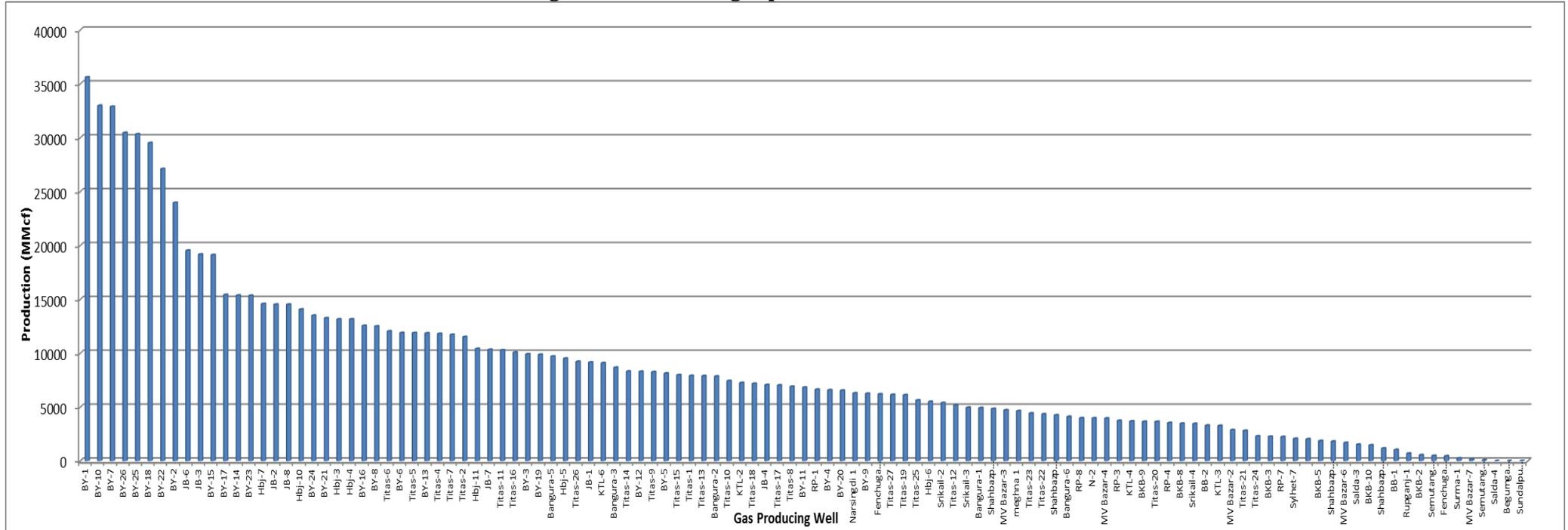
Total number of gas fields	27
Number of gas fields in production	20
Number of producing wells	112
Present gas production capacity	2750 MMcfd
Avg. gas production rate	1744-2750 MMcfd
Highest Production (6th May, 2015)	2785.80 MMcfd
Total recoverable (Proven + Probable) reserve	28.69 Tcf
Cumulative Production (June,2019)	16.93 Tcf
Annual Production by NOC	385.34 Bcf (40 %)
Annual Production by IOC	575.43 Bcf (60 %)
Remaining Reserve (Proven + Probable)	11.76 Tcf
Present Demand	3392 MMcfd
Present Deficit	61 MMcfd (along with LNG)
Number of Customer	43 Lakh (Appx.)

Figure 3: Historical Gas Production in Bangladesh (2005 - 2018)



Although natural gas was introduced as commercial fuel in early 1960s, its consumption got real momentum in eighties marking the beginning of the industrialization in the country.

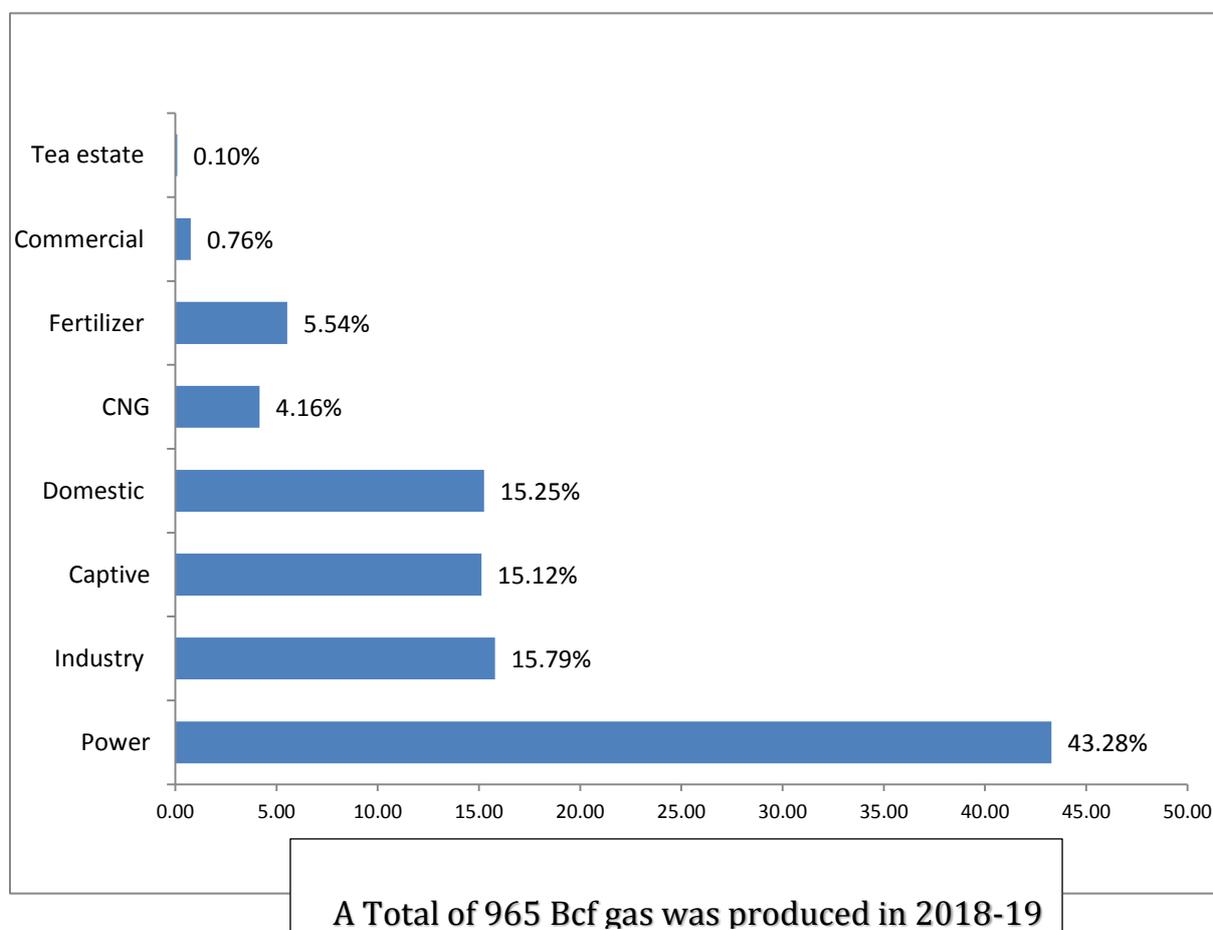
Figure 4: Well-wise gas production in 2018



3.3 Natural Gas Consumption

The current average production of natural gas is about 2644 MMcfd. A total 965 billion cubic feet (BCF) of natural gas was produced in 2018-19 which was used by power- 43%, fertilizer-5.5%, captive power-15%, industry-16%, domestic-15%, CNG - 4% and others very small amount. Natural gas accounts for the 68.5% grid electricity generation while all the 7 urea fertilizer factories are dependent on natural gas for feedstock. Natural gas has made tremendous contribution towards industrial growth in the country as fuel for heating and captive power generation at very favorable price. While the whole nation has been benefitted by this resource, about 7% of the populations have directly been benefitted by using piped natural gas for household purposes. Compressed Natural Gas is being used as automobile fuel by about 300,000 motor vehicles in the country. Expansion of CNG facilities early last decade dramatically improved air quality in large cities especially in the capital Dhaka as well as lot amount of foreign exchange has been saved due to less amount of oil import.

Figure 5: Sector wise Gas Consumption in Bangladesh (2018-19)



3.4 Natural Gas Demand

Being almost single indigenous sources of commercial energy demand for natural gas experienced vary fast growth over the last three decades often outstripping the supply. Present demand for gas in the country is about 3392 MMscfd whereas supply is 3331 MMscfd (Gas + imported LNG) indicating a shortage of about 61 MMscfd. It is estimated that demand for natural gas will rise to about 4622 MMscfd by the 2030. Natural gas demand projection in the country is shown in the figure below:

Table 3: Natural Gas Supply & Demand

Unit: mmcf

Year	* Pow er	Ferti- lizer	Cap. Pow er	Indus- try	Domes- tic	CN G	Com- mer- & Tea	Total De- mand	Total Sup- ply
2019	1284	316	480	710	425	139	38	3392	3331
2020	1334	316	480	776	425	139	38	3508	3477
2021	1384	316	480	842	425	139	38	3624	3500
2022	1662	316	432	908	425	130	38	3911	3769
2023	1786	316	389	974	420	125	38	4048	3915
2024	1780	316	350	1040	431	120	38	4075	4061
2025	1803	316	315	1106	442	110	38	4130	4300
2026	1844	317	283	1172	453	100	38	4207	4350
2027	1958	319	255	1238	465	100	38	4373	4400
2028	2087	321	230	1304	476	75	38	4531	4450
2029	2060	323	207	1370	488	75	38	4561	4500
2030	2058	325	186	1440	500	75	38	4622	4600

3.5 LNG import to Supplement Indigenous Supply

To meet the growing energy demand of the country, the government initiated the import of LNG from abroad. At present, a total of 1000 mmcf LNG is added to the national grid.

❖ **Floating LNG Terminal:**

- Agreement with Exceletrate Energy, Singapore has been signed for setting up FSRU. Already, floating LNG terminal has been installed in Maheshkhali in Cox's Bazar district. Currently, daily 500 mmcf re-gasified LNG is added to the national grid by Exceletrate Energy.

- SUMMIT LNG Terminal Co. (Pvt) Ltd. has signed the Agreement (BOOT) to set up FSRU at Maheshkhali in Cox's Bazar district with a capacity of supplying daily 500 mmcf re-gasified LNG. 500 mmcf re-gasified LNG is added to the national grid since April 2019.
- Negotiation is underway on the proposal of Reliance Power Limited, India on BOOT basis, to install 500 mmcf capacity floating LNG terminal in Kutubdia.
- Study activities are in progress to set up 500 mmcf capacity FSRU and Fixed Jetty Based LNG Receiving Terminal in Kutubdia Honkong Shanghai Manjala Power Ltd. Co. (HSMPL) with Global LNG & Petronas on BOOT basis.



Photo: Maheshkhali LNG Terminal

❖ **Land Based LNG Terminal:**

- (i) Consortium of China Huanqui Contracting & Engineering Corp. (HQC) and China CAMC Engineering Co. Ltd. has performed the Feasibility study on the proposal of 1000 mmcf capacity land based LNG Terminal in Maheshkhali. If the project is marked feasible then the next negotiation will be done.
- (ii) Feasibility study has been completed to establish 1000 mmcf land based LNG terminal at Kutubdia by Petronet India Limited. Since the project is feasible, a term-sheet has been signed with them. Negotiation has begun to sign an agreement.
- (iii) Tokyo Gas, Japan has been appointed as consultant for the feasibility study financed by Petrobangla for setting up land based LNG terminals in Payra port, rest of Kutubdia and Maheshkhali area. Feasibility study is in the final stage. Land based LNG Terminal will be installed in one or two places of these places if the study becomes feasible.

Table 4: LNG Scenario

Total LNG Import in June 2019	16.56	Bcf	0.02	Tcf
Cumulative LNG Import from August 2018 to June 2019	115.89	Bcf	0.12	Tcf
Cumulative MLNG Import from August 2018 to June 2019	106.03	Bcf	0.11	Tcf
Cumulative RLNG Import from April 2019 to June 2019	9.86	Bcf	0.01	Tcf

3.6 Exploration Activities

The exploration activities in Bangladesh are mostly limited to eastern folded belt and surrounding areas. On the basis of previous geo-scientific study, it seems that the middle part of the country geologically known as Bengal Fore deep and Eocene shelfal region popularly known as Hinge Zone also have high Potential for hydrocarbon exploration. The objective of 2D seismic survey is to explore remaining potential of the Bengal Foredeep hydrocarbon- geological province in the least explored part of the country. In this regard, two projects on 2D seismic survey being financed by the Gas Development Fund have been approved by the Govt. Besides, with a view to identify new locations for drilling well in the exploration gas fields of structures for mitigating the ever- growing crisis of gas , 3D seismic data were gathered during 2018-19 field-season over Fenchuganj and Rupganj gas fields. Moreover a joint study with Mitsui Oil Exploration Company Ltd. (MOECO), Japan and BAPEX for interpretation of 20 possible leads and prospects in block 8 & 11.

2D seismic Survey Activities: The work programs for carrying out 3600 Line Km of 2D seismic survey have been approved the authority. Areas to cover are Khulna and Bagerhat as well as Dhaka, Manikganj, Kishorganj, Narayanganj, Comilla, Faridpur, Gopalganj, Shariatpur, Madaripur, Narail, Netrakona, Kishorganj, Tangail, Gazipur, Jamalpur, Sherpur, Mymensingh and Bagura, of the exploration blocks 2B, 3B, Feni, Chittagong and Khagrachari of exploration blocks 10, 12, 13, 14 and 15. Seismic data already been collected from the target 3600 Km. About 8-9 prospective leads/prospects have been identified and well proposals have been recommended.

Under the 2D Seismic Survey over Exploration Block 3B, 6B & 7 Project of BAPEX, a total of about 2226 LKm 2D seismic data have been acquired by hired international seismic survey contractor during the field season 2017-2018 in Dhaka, Gazipur, Narayanganj, Munshigonj, Tangail, Rajbari, Faridpur, Shariatpur, Madaripur, Gopalganj, Barisal, Pirojpur, Jhalokhati, Patuakhali, Barguna, Bhola and Bagerhat areas under exploration block 3B, 6B & 7. After thorough investigation 20 potential seismic lead have been identified which demands extensive ex-

ploration activities to keep up the growing demand of natural gas for the last growing economic development of the country.

Under the 'Vision 2021' BAPEX has proposed 19 exploratory wells to be drilled under exploration Block-B & Block- 11. In order to accelerate oil and gas exploration activities, BAPEX is expected to find new resource in these areas by conducting highest quality 2D seismic exploration. From the fiscal year 2017-18, a project titled "Rupkalpa-9: 2D Seismic Project" has been approved by the Energy & Mineral Resources Division in the period of April, 2017 to June, 2019 to conduct 3000 LKm 2D seismic survey financed by gas development Fund (GDF) under Petro-bangla. This project has been designed to finalize the Proposed exploratory well location under vision 2021 by conducting regional to semi detail/close grid 2D seismic survey. The Project area includes Kishoreganj, Narsingdi, Gazipur, Tangail, Jamalpur, Sherpur, Mymensingh, Netrakona and Sunamganj districts. During FY 2017-2018, 810 LKm seismic survey has been completed. Processing of acquired data is going on.

3D Seismic Survey: With a view to meeting the growing gas demand of the country and demarcate new well locations in the discovered gas fields or hydrocarbon prolific structures, a project titled "3D Seismic Project of BAPEX" has been approved by the Energy & Mineral Resources Division for the duration of December, 2012 to November, 2019 with an estimated cost of 247.70 crore BDT financed from the Gas Development Fund (GDF). A work plan has been undertaken to acquire 3D seismic data over 2700 sq. km. area of Sunetra, Srikail, Sundalpur-Begumganj, Shahabazpur, Narsingdi, Mubarakpur, Rupganj, Fenchuganj and Semutang gas fields or structures. Data from a total of 500 sq. km. area gas been collected during 2017-2018 field season that includes 300 sq. km. area has been accomplished under this project so far. 3D seismic data interpretation of fenchuganj Gas Field and data processing of Rupganj gas field area is in progress.

As per the Government directives during this fiscal, two wells were drilled by Gazprom and two wells were drilled as five workover by BAPEX using its own rigs and crew.

Drilling Activities

Shahbazpur East-1 Exploratory Well: Under Rupkalpa-4 Drilling Project and a drilling contractor agreement concluded between BAPEX and Gazprom, the drilling operation of Shahbazpur East-1 well was started on 21 August 2017 and was completed on 18 October 2017. The well has been drilled as per the location and design given by BAPEX. About 25 mmcf/d gas is ready to be supplied.

Bhola North-1 Exploratory Well: Under Rupkalpa-4 Drilling Project and a drilling contractor agreement concluded between BAPEx and Gazprom, the drilling operation of Bhola North-1 well was started on 9 December 2017 and was completed on 23 January 2018. The well has been drilled as per the location and design given by BAPEx. About 25-30 mmcf/d gas is ready to be produced.

Salda North Exploratory well: Under the Rupkalpa-1 Drilling Project, the drilling operation of Salda North-1 well was started 11 May 2018 using Bijoy-10 (ZJ70DBS) Rig. The drilling ended up at 2815 metre depth.

Kasba-1 Exploratory Well: Under the Rupkalpa-3 Drilling Project, the drilling operation of kasba-1 well started 27 April 2018 using ZJ50DBS Rig. The drilling was terminated at 2975 metre depth.

Workover Activities

Shahbazpur-1 Workover: Under the Rupkalpa-4 Drilling Project, the workover operation of Shahbazpur-1 well started was on 10 January 2018 IPS Card Garder Denver rig and was complete on 26 May 2018. About 25 mmcf/d gas produced here to add to the national grid.

Begumganj-3 Workover: Under the Rupkalpa-5 Project, the workover operation of Begumganj-3 well was started on 13 March using IDECO rig and was completed on 23 June 2018. About 14 mmcf/d gas produced here to add to the national grid.

Habiganj-1 Workover: Under the agreement concluded between BAPEx & BGFCL, the workover operation of Habiganj-1 was started on 7 May 2018 using Bijoy-11 (ZJ40DBT) rig and was completed on 31 June 2018. About 15 mmcf/d gas produced here to add to the national grid.

Titas-15 Workover: Under the agreement concluded between BAPEx & BGFCL, the workover operation of Titas-15 started 19 November 2017 using IDECO Rig and completed on 6 December 2017 on completing the well. About 15 mmcf/d gas produced has been added to the national grid.

Kailashtila-1 Workover: After commissioning of the newly procured 650 HP (XJ650T) workover rig under Rupkalpa-10 Project, workover operation of Kailashtila-1 has been successfully carried out.

3.7 Offshore Planning (Current & Future):

- ✓ **Block SS-11 (Santos-Kris-Bapex)** : 3,146 km 2D seismic survey and 305 sq km 3D seismic survey completed. 1 search wells will be excavated by March, 2021.
- ✓ A total of 5,081 line km 2D seismic survey were completed in two blocks. At the end of the data analysis, 2 drilling locations have been assigned to SS-04 and 1 to SS-09. On December 2019, 1 drilling will be done on Block SS-04 and the remaining two drilling will be done by February, 2021.
- ✓ **Block DS-12 (POSCO-Daewoo)**: 5 probable leads were identified after analyzing 3,580 km 2D Seismic Survey. 2D seismic data processing is currently underway to gain a better understanding of the identified leads. Based on this, the next 1000 sq. km. 3D seismic survey will be done.
- ✓ Notice of Award has been sent to TGS-SCHLUMBERGER JV for conducting 2D Multi-Client Survey at sea. Negotiations are underway to sign a contract with the company.
- ✓ Draft Onshore Model PSC 2019 and Draft Offshore Model PSC 2019 have been approved at a meeting of the Cabinet Committee on Economic Affairs dated 24/07/2019.

3.8 Exploration of Unconventional form of energy

Exploration of different form of Unconventional energy like Coal Bed Methane (CBM), Shale gas, Underground Coal Gasification (UCG) is going on in search of alternate energy.

Petrobangla has undertaken a project to assess the potentiality of coal bed methane in Jamalganj coal deposit, the largest and deepest coal deposit in the country.

A Preliminary Study on Shale Gas Potentiality in Bangladesh has been prepared by the Hydrocarbon Unit. Hydrocarbon Unit has prepared another report titled “Action Plan and Guide lines for CBM, UCG and Hard Rock Development in Bangladesh”.

4.0 Oil (Petroleum) Sector

4.1 Organizational Structure

Bangladesh Petroleum Corporation (BPC) under the Energy & Mineral Resources Division of the government is the nodal organization in the petroleum sectors which deals with import of crude oil and products, oil refining and marketing finished petroleum products. One refining company with lone crude oil refinery in Chittagong is engaged in refining of crude oil while four oil marketing companies are responsible for marketing of finished products across the country. Oil business used to be government monopoly until 1997 when one private com-

pany entered in fractionation of gas condensate extracted from gas fields. Presently, gas condensates, are fractionated by small scale fractionation plants of Petrobangla, BPC and private entrepreneurs. Besides, there two petrochemical plants in the private sector that imported condensate as feed.

4.2 Supply and Consumption of Oil

Petroleum products viz. diesel, petrol, octane furnace oil etc., account for about 22% commercial energy supply in the country. Liquid fuel used in Bangladesh is mostly imported. Locally produced gas condensate shares only 6% of total liquid fuel consumption. Bangladesh imports about 1.36 million metric tons of crude oil along with 6.7 million metric tons (approx.) of refined petroleum products per annum. About 4118 thousand BBL per year locally produced gas condensate, which is fractionated mainly into petrol, diesel and kerosene, is the only domestic source of liquid fuel. Major consumer of liquid fuel is transport followed by power, agriculture, industry and commercial sectors. Sector-wise consumption of petroleum products are: transport-50.26%, power-24.36%, agriculture 16.37%, industry 5.32%, domestic-3.21% and others 0.48%.

Table 5: Petroleum Sector at a Glance (2018-19)

Product	2018-19 (in Ton)
Import of Refined Oil by BPC	4,863,711
Import of Furnace Oil by BPC	318,634
Import of Crude Oil by BPC	1,361,877
Total import by BPC	6,544,222
Import of Furnace (Private)	1,614,310
Production of Condensate	523,123
Total Sale	8,658,532
Export of Naptha	36,513
Storage Capacity of BPC	1,300,000
Refining Capacity of ERL	1,250,000
LPG Production from ERL	12,832
LPG Production from Kailashtila Frac. Plant	5321
LPG import (private)	681,036

Table 6: Sale of Petroleum Products by BPC during last 8 Year
Quantity in MT

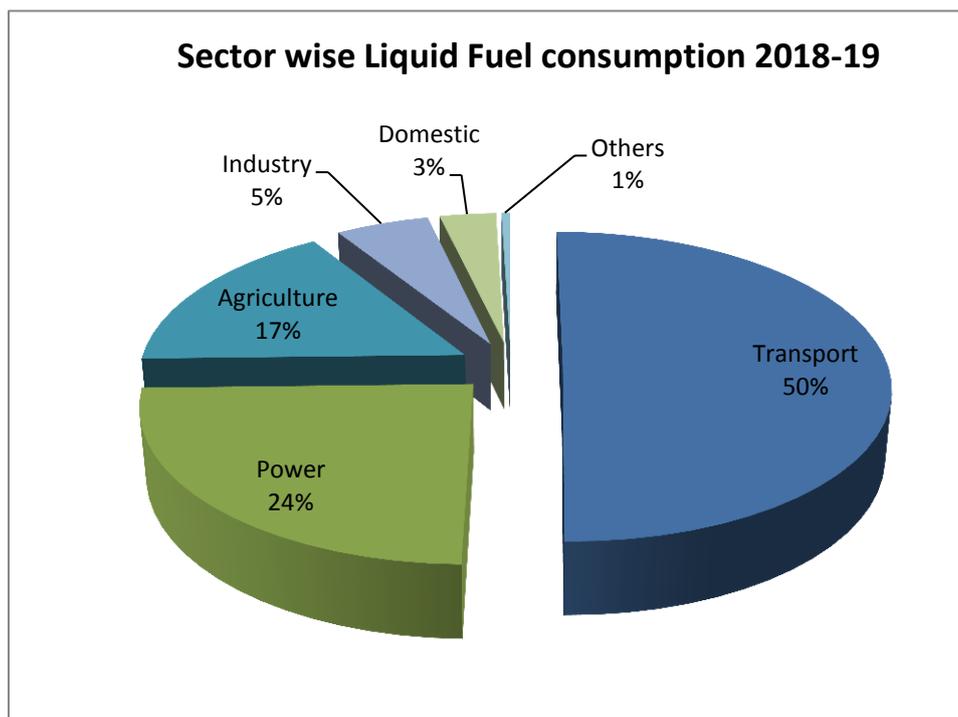
Products	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Octane	107150	110850	117452	126114	147557	186911	230280	266988
Petrol	158707	169710	178674	166823	137360	232359	284668	318593
Diesel	3240349	2962872	3242554	3396061	3606404	4000044	4835712	4593486
Kerosene	358436	314450	289871	263029	213685	170993	138403	121497
Furnace Oil	883735	1070096	1202505	906771	711889	806440	925150	683725
Jet A-1	311890	318423	323327	338829	347323	376700	408272	429951
Others	153379	131591	130583	123796	91802	115283	125851	129982
Total	5213646	5077992	5484966	5321423	5256020	5888730	6948336	6544222

Diesel is the dominant liquid fuel used in the country. Petroleum products used during last seven years are shown in the above table.

Table 7: Sector wise petroleum consumption 2018-19

Sector	Uses amount in M.T.	%
Transport	3289126	50.26
Power	1594172	24.36
Agriculture	1071289	16.37
Industry	348153	5.32
Domestic	210070	3.21
Others	31412	0.48
Total	6544222	100

Figure 6: Sector wise Liquid Fuel Consumption in Bangladesh (2018-19)



4.3 Capacity Enactment Projects

Eastern Refinery Limited (ERL) installed in 1968 at Chittagong with the processing capacity of 1.5 million tons annually, now dated to around 1.25 million tons per year. A Project has taken for installation of 2nd unit of the existing refinery with annual refining capacity of 3 (three) million tons. Besides the state initiative, government allowed private entrepreneurs to establish Condensate Fractionation Plants to split Natural Gas Condensate (NGC) received from various gas fields in Bangladesh as well as imported NGC.

Total storage capacity of different grades of petroleum is around 1.3 million metric tons across the country. It may be mentioned that, according to the national energy policy, 60 days stock of petroleum products to be maintained for energy security of the country. But at present BPC is able to maintain 35 to 40 days stock of petroleum products due to lack of storage capacity as well as involvement of huge amount money for procuring petroleum. BPC has taken a project for construction of **Mongla Oil Installation** as 2nd main installation to enhance 0.10 million metric tons with 14 oil storage tanks.

Single Point Mooring (SPM) project is now in progress which will enable BPC to receive Crude Oil and Diesel from large size vessels of 120,000 metric tons carrying capacity through subsea pipeline, from near Kutubdia of the Bay of Bengal, within 48 hours instead of present required time of 9/10 days. Storage facility will be constructed of 0.24 million metric tons, for crude oil 0.15 million metric tons and for diesel 0.09 million tons, at Maheshkhali under SPM

Project for smoothing receiving of petroleum. Operational flexibility will improve amazingly after completion of the SPM project.

Upcoming major projects of BPC:

- India-Bangladesh Friendship pipeline (IBFPL).
- Installation of Custody Transfer Flow Meter at ERL Tank farm.
- Terminal Automation of marketing companies of BPC.

4.4 Demand for Petroleum Products

Demand for petroleum products is growing at the rate of 2 to 4% per year. If this trend continues demand for oil will increase to about 15 million tons by the year 2030. Government of Bangladesh has decided to make road connectivity with the neighboring countries like India, Nepal, Bhutan etc. Transport movement will increase remarkably in Bangladesh territory to avail port facilities Chittagong and Mongla ports by our neighbors. However, future demand will depend upon the future energy mix in the country and availability of other fuels.

4.5 Source Countries for Imported Oils

ADNOC Of UAE and Saudi Aramco of Saudi Arabia are suppliers for crude that BPC imports while finished products are imported from 13 National Oil Companies (NOC) of different countries. A project is in active consideration by the government to import diesel, produced in Numaligarh Refinery Limited (NRL) in Assam, from its marketing terminal at Shiliguri through pipeline to Parbatipur depot at Dinajpur district of Bangladesh.

5.0 Liquefied Petroleum Gas (LPG)

Demand of Liquefied Petroleum Gas (LPG) in Bangladesh is very high. In the public sector 19,228 MT of LPG are bottled in 2018-19, out of which 12,832 MT is obtained as byproduct from processing of crude oil in Eastern Refinery and 5321 MT from is extracted from natural gas in Kailashtila gas field. LPG is imported by only private sector. Around 681,036 MT of LPG is imported and marketed by private sector entrepreneurs in 2018-19. So public and private sector combining do the marketing of 700,264 MT of LPG in 2018-19, which is meeting a certain portion of LPG demand of the country. Considering the rising demand for LPG, government has decided to enhance LPG bottling facilities for marketing more imported LPG. For this purpose, two LPG bottling plants, each having capacity of 100 thousands MT per annum, will be set up in the coastal area. Of them, one plant will be installed by Bangladesh Petroleum Corporation (BPC) and the other in public private partnership with BPC.

Table 8: LPG scenario of last 5 year

Year	Public Sector Production MT	Import (Private) MT	Total MT
2014-15	17,574	110,000	127,574
2015-16	14,000	172,792	186,792
2016-17	16,382	307,000	323,382
2017-18	15,936	537,686	553,622
2018-19	19,228	681,036	700,264

6.0 Coal

In Bangladesh, the reserve of coal (Bituminous Coal) is about 31,00 million tones which is equivalent to 85 Tcf gas in 5 coal fields so far discovered, namely Barapukuria, Khalaspir, Phulbari, Jamalganj and Dighipara. If initiatives are taken for exploration all over the country, there are enough possibilities to discover more coal mines. Out of the discovered mines, coal from 4 deposits (118-509 meters) is extractable at present. Production from Jamalganj may not be viable with present day's technology due to the depth of the deposits.

Table 9: Coal Fields of Bangladesh

Place/Field (Discovery Year)	Depth (Meter)	Area (Sq.Km)	Reserve (Million Ton)	Depth (Meter)	Calorific Value (BTU/lb)
Barapukuria, Dinajpur (1985)	119-506	6.68	390	119-506	11,040
Khalaspir, Rangpur (1995)	257-483	12.00	523	257-483	12,700
Phulbari, Dinajpur (1997)	150-240	30.00	572	150-240	11,900
Jamalganj, Jaipurhat (1965)	900-1000	16.00	1,054	900-1000	11,000
Dighipara, Dinajpur (1995)	327	15.00	600	327	13,090
			Total = 3139		

Coal might be the alternative fuel to natural gas. These coals can conveniently meet the energy needs of Bangladesh for 50 years. It is notable that the coal of Bangladesh is considered to be high quality in terms of its high level of heat generation capacity as well as low sulphur content.

Table 10: Coal scenario of last 5 year

Year	Public Sector Production	Import (Private)	Total
2014-15	675,775.50	1,812,030	2,487,806
2015-16	1,021,638	3,812,060	4,833,698
2016-17	1,160,657.81	2,801,407	3,962,065
2017-18	923,276.00	3,394,534.24	4,317,810
2018-19	803,315.00	5,754,025	65,57,339

Commercial production of Barapukuria Coal Mine commenced from 10 September 2005 using underground mining method with the targeted capacity of one million metric ton per year. Almost 65% of the production is being used by 250 MW (2x 125 MW) Coal fired power station operated by Power Development Board of Bangladesh near Barapukuria coal mine. Remaining 35% coal is being used in brick fields and other domestic purposes which have an impact of reducing deforestation. A total of 10.75 million metric ton of coal has been extracted from its inception up to June 2019. At present Barapukuria Coal Mine is producing at an average 2500-3000 MT coal per day.

7.0 Peat

The peat deposits of Bangladesh are located in the low lying areas of the alluvial plain which are generally submerged under water for a large period each year. Peat occurs in Baghia-Chanda beel under Madaripur and Gopalganj district, Kola Mouza of Khulna district, Chatal beel area of Moulavibazar district, Pagla, Dirai and Shalla area of Sunamganj district, Chorkai area of Sylhet district, Brahmanbaria Sadar upazila of Brahmanbaria district and Mukundapur area of Habiganj district. It has a carbon content of 50-60% and has a calorific value between 5500 Btu/lb and 7000 Btu/lb. The peat occurs at the surface or at shallow depths below the surface. The total peat reserve (dry peat) discovered in Bangladesh is 146.36 million ton. There is no commercial utilization of peat in Bangladesh at present. Peat can be conveniently used in the form of briquette, ovoid and compressed tablets as an alternative fuel to household work, in brick and lime industries and in small capacity thermal power plant (10 MW) in rural areas. Three exploration licenses of peat is granted in Rajoir Upazila of Madaripur and Kotalipara Upazila of Gopalganj district.

8.0 Condensate and Natural Gas Liquids (NGL)

Some of the gas fields located in north - eastern part of Bangladesh contains high percentage of liquid hydrocarbon. Extraction of this liquid, especially value added by-products, is becoming a growing activity. Apart from the condensate fractionation plant installed in differ-

ent gas fields, Rashidpur Condensate Fractionation Plant with a capacity of 3750 bbl/day is producing petrol, diesel and kerosene by fractioning the condensate received from Bibiyana Gas Field. During 2018-19, a total of 476,311 barrels of condensate was produced by SGFL, BGFCL and BAPEX and 3,641,569 barrels by IOCs as a by-product of gas. During the same period, SGFL, BGFCL and BAPEX extracted 27,305,000 litre or 171,740 barrels of NGL from the gas processed at its Mole-Sieve Turbo Expander plant at Kailashtila. On the other hand, a total of 181,716,000 litre of petrol, 52,090,000 litre of diesel and 23,081,000 litre of kerosene was produced by fractionating the condensate at the fractionation plants located at different fields of SGFL, BGFCL and BAPEX.

9.0 Power Sub-Sector

9.1 Primary Energy Mix for Power Generation

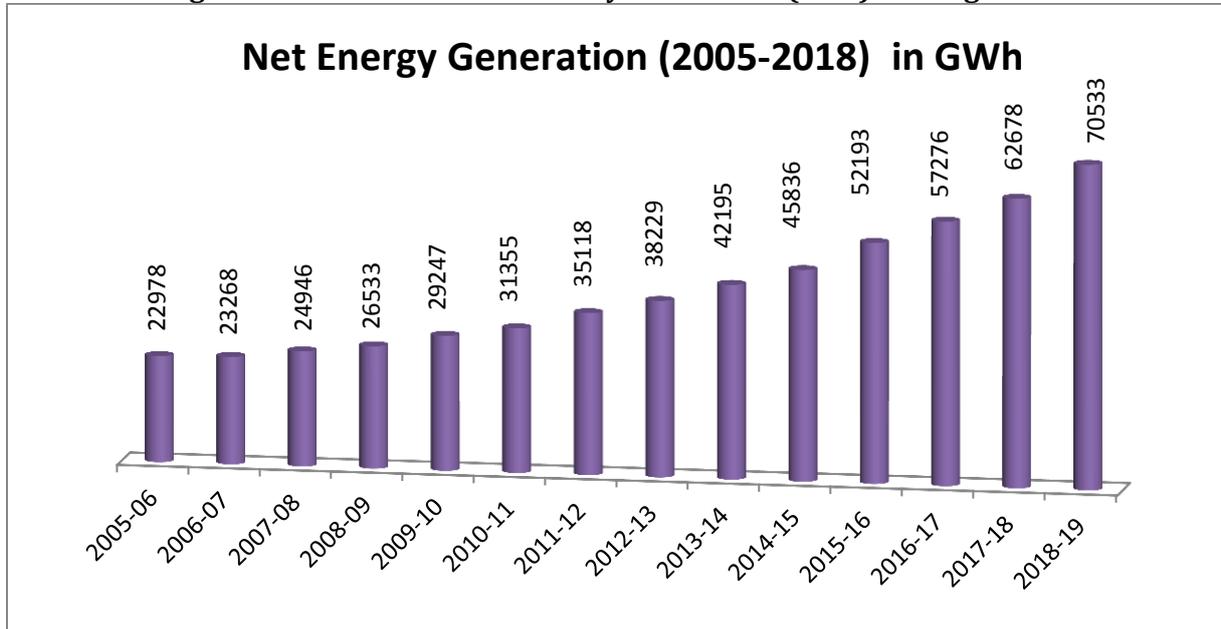
As of June 2019, the total power generation capacity combining public and private sector was 22051 MW, leaving 20% capacity for maintenance and forced outage, available generation capacity should be about 17641 MW without fuel constraint. Maximum generation actually obtained till 30 June 2019 was 12893 MW, which was less than 17641 MW. It might have occurred due to fuel supply constraint. Of the total generation capacity, distribution between public sector and private sector entities are 52% and 43% respectively and from import 5%. Bangladesh has started importing 500MW electricity from India (started in October 2013) additional 100 MW from March'16 and 560 MW from December 2018 which contributed 9% of total power generation.

Table 11: Bangladesh's Power Sector: At a Glance (2018-19)

Electricity Growth	17.59%
Installed Capacity (MW)	22051
Maximum Generation (MW)	12893 (21 th May 2019)
Total Consumers (in Millions)	34.30
Transmission Lines (km)	11650
Distribution Lines (km)	532000
Per Capita Generation (including Captive)	510 Kwh
Access to Electricity (including Off-Grid Renewable)	95%

The composition of primary energy mix for power generation in FY 2018-19 is shown in Figure 8. Of the total electricity generated in 2018-19, 72% was generated from domestic fuels (natural gas, coal & hydro) and 19% from imported petroleum fuels (diesel and furnace oil) and 9% was electricity Import from India as cross border energy trade.

Figure 7: Historical Net Electricity Generation (Gwh) in Bangladesh



Total Net Electricity Generation (2018-19): 70533 Gwh

Figure 8: Power Generation by Fuel Type (2018-19)

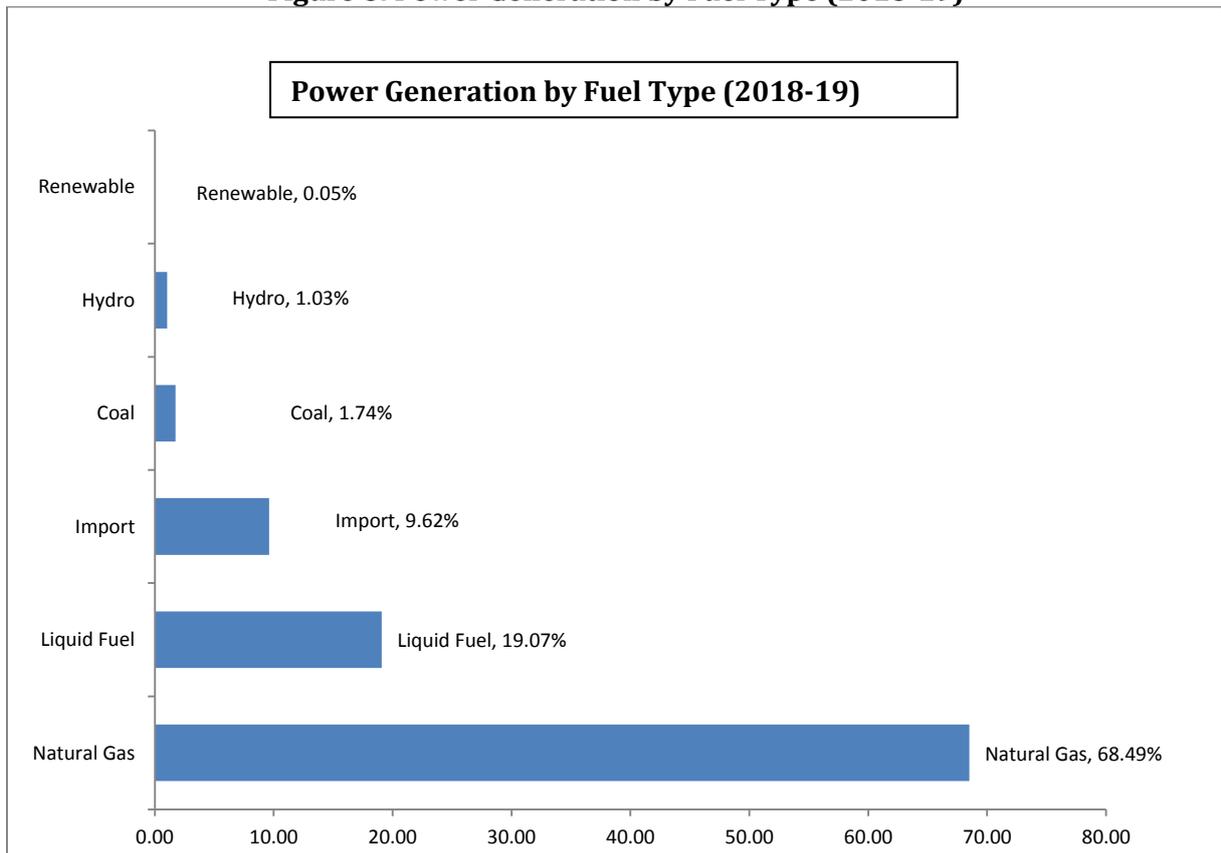
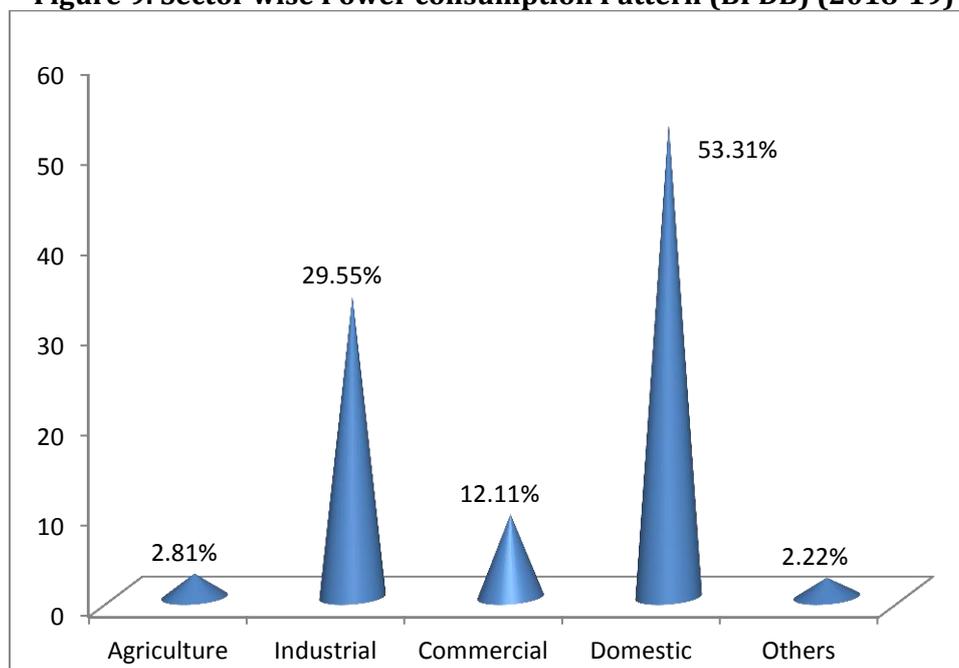


Figure 9: Sector wise Power consumption Pattern (BPDB) (2018-19)



9.2 Electricity Import

Bangladesh has entered into the era of cross border energy trade in October 2013 by importing electricity from India. Additional 100 MW from March 2016 from Tripura. At present 1160 MW electricity is being imported from India and in near future it will increase considerably.

10.0 Renewable Energy Resources

Renewable energy resources could assist in the energy security of Bangladesh and could help reduce the natural gas demand. Regions of the country without supply or access to natural gas or the electric grid use biomass for cooking and solar power and wind for drying different grains and clothes. Biomass is currently the largest renewable energy resource in use due to its extensive noncommercial use, mainly for cooking and heating. Biomass comprises 27 percent of the total primary energy use in Bangladesh. The country has a huge potential for generating solar power. Moreover the use of renewable energy has become popular worldwide in view of the depleting reserves of non-renewable fossil fuels. Renewable energy is environmentally friendly.

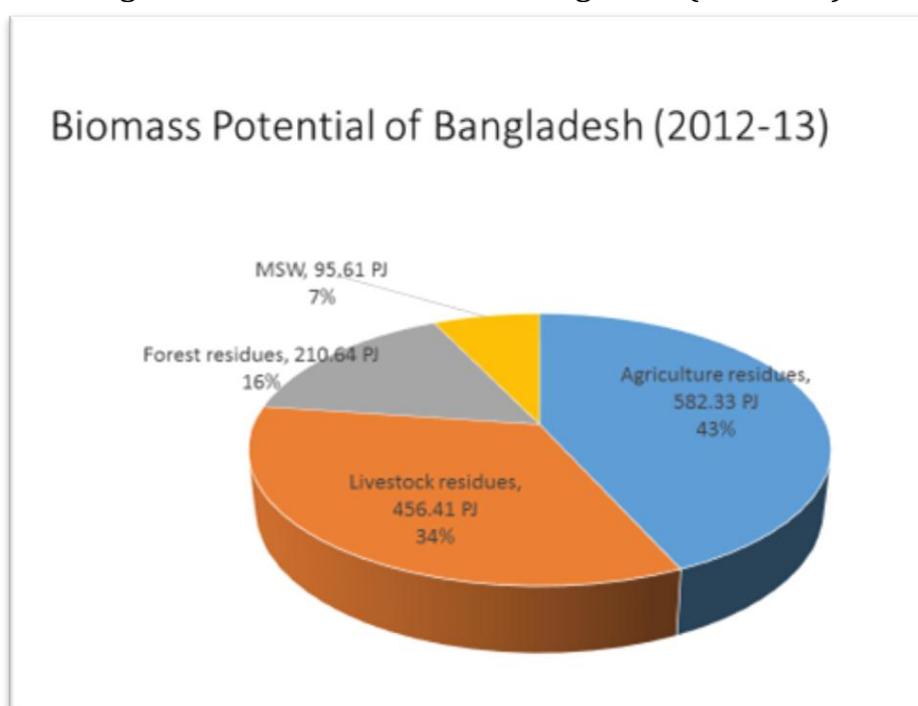
Renewable energy resources used in Bangladesh may be classified into three major types- (i) traditional biomass fuels, (ii) conventional hydropower, (iii) new-renewable resources (e.g. solar PV, wind, biogas etc.) of energy.

10.1 Traditional Biomass fuels

In Bangladesh, three major types of biomass fuel resources are in use: wood fuels, agricultural residues and animal dung. Wood fuels are obtained from different types of forests and tree resources grown in rural areas. Agricultural residues and animal dung contribute a substantial portion of biomass fuel in Bangladesh. A part of the total agricultural residues available during harvesting of crops and a part of total animal dung produced by animal resources are used as fuel. Availability of these resources (agricultural residues, animal dung) as fuel depends on local situation and socio-economic condition of the owners.

Converting biomass into more energy efficient fuel is a means of upgrading the rural energy consumption pattern. Biogas is very suitable for cooking and lighting (Mantel/Hazak) and for running a small generator to produce electricity. Throughout Bangladesh, there are currently about 80,000 households and village-level biogas plants in place. Around 50,000 domestic biogas plants already installed by IDCOL. There is a real potential for harnessing basic biogas technology through rural electrification, village-level biogas production, and internal combustion (or even micro turbine) power generation.

Figure 10: Biomass Potential of Bangladesh (2012 - 13)



The power generation of the country largely depends on the non-renewable (fossil fuel) energy sources, mainly on the natural gas. This trend causes rapid depletion of non-renewable energy sources. Thus, it is necessary to trim down the dependency on non-renewable energy sources and utilize the available renewable resources to meet the huge energy demand facing the country. Most of the people living in rural, remote, coastal and isolated areas in Bangladesh have no electricity access yet. However, renewable energy resources, especially biomass can play a pivotal role to electrify those rural, remote, coastal and isolated areas in the country. Humankind has been using biomass as an energy source for thousands of years. In a study (Paul & Others) assesses the bio-energy potential, utilization and related Renewable Energy Technologies (RETs) practice in Bangladesh. Improved cooking stove, biogas plant and biomass briquetting are the major RETs commonly practiced in Bangladesh. The assessment includes the potential of agricultural residue, forest residue, animal manure and municipal solid waste. The estimated total amount of biomass resource available for energy in Bangladesh in 2012–2013 is 90.21 million tons with the annual energy potential of 45.91 million tons of coal equivalent. The recoverable amount of biomass (90.21 million tons) in 2012–2013 has an energy potential of 1344.99 PJ which is equivalent to 373.71 TWh of electricity.

10.2 Conventional Hydropower

Total hydropower potential of the country was reported as 1500 MkWh/year at Kaptai (1000MkWh/year). Matamuhury (300MkWh/year) and Sangu (200MkWh/year) (GOB 1996). In 2018-19, total generation capacity of 5 hydropower units installed at Kaptai was 230MW and electricity generated was 8934 MkWh. Depending upon rainfall, yearly electricity generation capacity of hydro plants varies between 700 MkWh to 1000 MkWh.

It was reported that a feasibility study was undertaken in 1998 to establish additional hydropower units (Nos. 6 & 7) at Kaptai with generation capacity of 100MW. There is potential to install hydropower plant at the Sangu and the Matamuhury rivers in the Chittagong Hill Tracts and possibility of constructing a second dam, six kilometers downstream of existing Kaptai dam to generate hydropower. Though in Chittagong Hill Tracts local population are already conscious about the negative impacts of existing hydropower plants at Kaptai proper rehabilitation program should be under taken. Considering the energy scarcity of the country, the feasibility of harnessing additional electricity through conventional hydropower technologies and mini & micro hydropower technologies should be explored to meet a part of future energy needs.

10.3 New-Renewable Energy Resources

It was mentioned in the Renewable Energy Policy 2008 that 5% and 10% of total electricity would be generated using renewable energy by 2015 and 2020 respectively (GOB 2008).

SREDA Act 2012 was enacted for the establishment of Sustainable & Renewable Energy Development Authority (SREDA) for promotion of efficient energy and renewable energy technology. The authority (SREDA) is in the process of institutionalization. Total generation of electricity from renewable energy sources (e.g. solar PV, biomass, biogas etc.) up to June 2019 was 368 MW. Total generation from RE including hydropower (230MW) was 598 MW, which was 3% of total electricity generation capacity (22,051 MW) of the country including off grid, RE and Captive.

In line with the policy, government has already taken different initiatives in renewable energy development, in which some projects/programs have been completed and some are under implementation.

i. Solar Energy

Bangladesh is geographically located in a favorable position (within 20°34' to 26°38' north latitude) for harnessing sunlight, available abundantly for most of the year except for the three months June-August when it rains excessively. The amount of Solar Energy available in Bangladesh is high about 4 to 7 kWh/m²/day, enough to meet the demand of the country. There is a fast-growing acceptance of rural people to solar photovoltaic (PV) systems to provide electricity to households and small businesses in rural off grid areas. The Rural Electrification Board (REB), a government agency has been engaged in commercializing solar power electrification of domestic, commercial, irrigation in rural area. IDCOL, a government-owned entity has disseminated some SHS through its partners NGOs. Due to higher cost of its production it has to go a long way to become commercially competitive. However, in remote areas of Bangladesh it is gradually becoming popular and government has undertaken a lot of scheme to subsidize on it. Government has planned to setup solar panel with capacity of 5~10 MW.

[Solar Home System (SHS)]

Solar Home System (SHS) provides reliable power for lighting and operating low powered appliances such as radio, television, small electric fans. The electricity provided by a SHS can also be used to run Direct Current (DC) driven equipment such as DC shouldering irons, drilling machines etc. and to charge the battery of mobile phones. Larger systems can run computers, refrigerators, pumps etc. IDCOL and BREB are distributing Solar Home System (SHS) to the people living in the off-grid areas. IDCOL through different partner organization has already distributed about 55 lakh (installed capacity 250 MW) SHS and BREB distributed about 30 thousand SHS throughout the country.

[Solar Irrigation System]

Solar powered irrigation is the breakthrough technology for energy stricken agro-based economy. Solar powered irrigation is the innovative and environment friendly solution for the

irrigation system, which currently depends on hugely inefficient electric and diesel pumps. Gradually replacing the electric and diesel pumps for irrigation with solar water pumps could save significant capacity of electricity and huge investment cost. Up to June'19, a 1158 nos solar irrigation pump has been installed by IDCOL.

ii. Bio fuel

Bio fuels can be produced from a variety of plants like rapeseed, mustard, corn, sunflower, canola, algae, soybean, pulses, sugarcane, wheat, maize, and palm. The most popular option for producing bio-fuels is from non-edible oilseed bearing trees. The two most suitable species are:

Jamal gota (*Jatropha curcas*) and Verenda (*Ricinus Communis*). Both of these trees can grow virtually anywhere in any soil and geo-climatic condition.

Bio-fuel use is not new in Bangladesh. In the early 20th century, bio-fuel was used for lighting lamps or lanterns. In an agriculturally based country like Bangladesh, bio-fuel can be a better alternative because a 30 percent blend of bio-fuel can be used along with our diesel or petrol. This can also be an excellent fuel to kindle lamps in rural Bangladesh.

The use of bio-fuel is increasing in most European countries. Germany has thousands of filling stations supplying bio-fuel and it is cheaper than petrol or diesel. The German government declared that 5 percent of every liter of fuel must be bio-fuel by 2020.

iii. Wind Energy

Bangladesh is exploring the potential of wind power. In the coastal area of Bangladesh, windmills with a capacity of 2.9 MW are in operation. Bangladesh has had to wait for a breakthrough in wind power technology to be competitive against other conventional commercial energy sources. A pilot project to install windmills along the seashore with a capacity of 20 MW has been planned by the government. Based on the results of the pilot project, another 200 MW of power could be harnessed from wind power.

Rising fossil fuel and CO₂ prices, technological advances and economies of scale with wider deployment are expected to make renewable-based systems increasingly cost-competitive in coming decades (IEA 2011).

iv. Tidal Energy

The tides at Chittagong, south east of Bangladesh are predominantly semidiurnal with a large variation in range corresponding to the seasons, the maximum occurring during the

south-west monsoon. A strong diurnal influence on the tides results in the day time tides being smaller than the night time.

In the year 1984, an attempt was made from the EEE department of BUET, Dhaka to access the possibility of tidal energy in the coastal region of Bangladesh, especially at Cox's Bazar and at the islands of Maheshkhali and Kutubdia. The average tidal range was found to be within 4-5 meter and the amplitude of the spring tide exceeds even 6 meter. From different calculation it is anticipated that there are a number of suitable sites at Cox's Bazar, Maheshkhali, Kutubdia and other places, where a permanent basin with pumping arrangements might be constructed which would be a double operation scheme. Tidal energy might be a good alternative source for Kutubdia Island where about 500 kw power could be obtained. At present there are only 2x73kVA diesel generator sets to supply electricity for 5-6 hours/day for 72,000 people and there is practically no possibility of main grid supply in the future.

v. Wave Energy

Until to now no attempt has been made by Government of Bangladesh to assess the prospects for harnessing energy from sea waves in the Bay of Bengal. Wave power could be a significant alternative source of energy in Bangladesh with favorable wave conditions especially during the period beginning from late March to early October. Waves are generally prominent and show a distinct relation with the wind. Waves generated in the Bay of Bengal and a result of the south-western wind is significant. Wave heights have been recorded by a wave rider buoy and correlated with wind data. Maximum wave heights of over 2 m, with an absolute maximum of 2.4 m, on the 29 July were recorded. The wave period varies between 3 to 4 sec for waves of about 0.5 m, and about 6 sec for waves of 2 m.

In Bangladesh wind speeds of up to 650 kmph (400mph), 221 kmph (138 mph) and 416 kmph (260 mph) have been recorded in the years 1969, 1970 and 1989 respectively. Severe cyclonic storms and storm surge of up to 15 m have been reported. Plant must also be able to survive the exceptional occurrence of very high waves in storm conditions.

vi. River Current

A network of rivers, canals, streams etc. numbering about 230 with a total length of 24140 km covers the whole of Bangladesh flowing down to the Bay of Bengal. Different sizes of boats are the main carriers of people and goods for one place to another. Boatmen usually use the water-sails to run their boasts against the wind direction. But until now no research has been reported to utilize the energy of river current properly.

vii. Waste to Electrical Energy

Dhaka City has been suffering for a long time from a tremendous environmental pollution caused by municipal solid waste, medical waste and various industrial wastes. In order to save the city from environmental pollution the waste management as well as electricity generation from the solid wastes program is being taken by the Government.

11.0 Nuclear Power

Nuclear powers is characterized by very large up-front investments, technical complexity, and significant technical, market and regulatory risks, but have very low operating costs and can deliver large amount of based load electricity while producing almost no CO₂ emissions. Typical construction times are between five and eight years from first concrete poured. Government of Bangladesh has signed a general contract with Russia on December 25, 2015 for the construction and commissioning of the country's first nuclear power plant (2*1200 MW) at Rooppur in Pabna at the cost of \$12.65 billion.

Table 12: Planned Nuclear Power Reactors:

Unit	Type	Capacity	Construction start	Commercial Operation
Rooppur 1	VVER-1200/V-523	1200 MW	Oct 2017	2023 or 2024
Rooppur 2	VVER-1200/V-523	1200 MW	2018	2024 or 2025

All fuel for Rooppur is being provided by Rosatom, and all used fuel is to be repatriated to Russia, in line with standard Russian practice for such countries. A draft agreement on used fuel was signed in March 2017, totaling about 22.5 ton/yr from each reactor (42 fuel assemblies, each with 534 kg of fuel). A further agreement for repatriation of used fuel for reprocessing was signed in August 2017.

The Bangladesh Atomic Energy Commission (BAEC) has taken an initiative to conduct a survey in eight char areas of southern region to select one or two suitable sites to set up the country's second nuclear power plant, aiming to meet the future demand of huge electricity. The study will cover a demographic survey over a 5-km diameter, seismic stability, geological location, and power infrastructure and communication system.

12.0 Conclusion

The government has taken several steps to deal with the reduction in the production of gas. Exploitation and exploration of domestic resources have been emphasized. Power Sector Master Plan has already been formulated and initiative has been taken to produce a large portion of the electricity using coal. Gas exploration activities by BAPEX have been strengthened and some prospective wells have already been identified. Discoveries of more new wells are much expected in the future. Besides onshore, exploration activities are being undertaken in the offshore and fields with large amount of gas are expected. In some old gas fields, the 3D Seismic survey has revealed more reserves of gas than before. For example, using new technology Bibiyana gas field found an increase of its reserve and a further production for some additional periods will continue. The government has taken initiative to meet the demand of energy through import of LNG, already LNG supplies have started and more LNG will be added to the national grid in the next few years. GSMP has been formulated and new entrepreneur-friendly PSC has been revised. Moreover, government has taken several steps to boost up the coal sector. ERL expansion is underway and SPM project has been initiated. New horizon has been exposed in sea after settlement of maritime boundary with Myanmar and India. Cross border energy trade will get momentum. Considering all the perspectives, we hope that in the near future, Bangladesh is well prepared to meet the Energy demand and ensure the supply of uninterrupted energy for achieving the 7FYP, Vision-2021, SDG-2030 and Vision-2041.