

# Fuel Options for Bangladesh-2017

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## Abstract

Fuel is an essential commodity supporting our daily life and economy. Until today, the majority of Bangladesh fuel is met from domestic natural gas production. With economy growing (like GDP 7%+) in coming years, fuel use is also increasing and the local gas production could not meet the requirement. Government has already taken steps for the import of LNG and LPG to support the shortfall. This paper describes different fuel options and suggests that the additional fuel requirement might be met with the imported LNG considering the environmental and cost of fuel. LPG is costly than imported LNG. So, emphasis on LPG use may be considered only to the areas where there is no pipe gas supply.

**Keywords:** Fuel Options, LPG, LNG, Natural Gas, Electricity

## 1. Introduction

Fuel is a daily essential commodity of our life. In Bangladesh, Natural gas is the prime fuel used for domestic cooking, transport, electricity, fertilizer production, other commercial and industries. The use of natural gas in this country started since 1960-today about 70% of the fuel need is met through natural gas (except bio mass). About 2700 mmscf is produced and distributed daily around greater Dhaka, Chittagong, Comilla, Noakhali, Bhola and Sylhet. The countries north and south regions are almost without natural gas supply, except a few places. The present gas shortage has been estimated about 500 mmscf daily. Some industries like fertilizer plants operate only several months for shortage of natural gas. The gas supply to the domestic cooking is also stopped.

As an alternative, use of LPG (liquefied Petroleum gas) is being encouraged. The country's (Eastern Refinery) yearly LPG production is only 20 thousand MT while the import amount is about 300 thousand metric ton from international market supply. The majority LPG use is restricted to domestic and commercial cooking and the use is being encouraged. The advocacy for the use of LPG is that piped natural gas supply is costly.

Importing natural gas as LNG is costly. A separate, dedicated safety terminal is required. The natural gas temperature is reduced down to minus 162°C in order to liquefy it. Then, the liquid natural gas is shipped to the special jetty. It is unloaded, regasified and pressurized for the supply. The transport and supply cost of LNG is 3 to 4 times than its gas purchase cost.

The proven reserve of the country natural gas is 10-12 trillion cubic feet. About 1 trillion cubic feet is being used every year. If further new gas fields are not discovered, the present gas reservoir will deplete within a decade. It is estimated that more than 8000 mmscf natural gas will require to keep

the economy up by the year 2030. This is about 3 trillion cubic feet yearly. So, imported LNG and LPG will play a strong role in the future energy requirement in Bangladesh.

Petrol, Kerosene, Diesel, and furnace oil are being used as a liquid fuel. But its use is decreasing because of high cost and detrimental environment issue. Solar energy is being practiced on a limited scale to meet the domestic light use in rural Bangladesh.

Wood, dried leaf, rice husk are still the major cooking fuel in many villages, districts and Thana/upozelas in Bangladesh.

The good news is that enough LPG and LNG is available in the international market and the supply will continue for several decades. All the developed and developing countries in Asia like Japan, China, South Korea, India, Singapore, Pakistan, Thailand are increasingly depending on the LNG and LPG supply because of its environment and clean fuels.

The important issue is price. LNG and other fuel price fluctuates like a sinusoidal curve in the international energy market.

Fuel supply has different options in its use considering the cost, technology and its environmental effect. This paper discusses and highlights fuel use options in the country based on 2017 situation.

## 2. The present Fuel supply and price in Bangladesh:

**2.1 Natural gas:** Bangladesh natural gas production is from onshore mainly in the greater district of Sylhet and Comilla. It is pure and mainly 97% methane and with some higher hydrocarbon. The sulfur content is very low like 5 ppm. The natural gas is lighter than air and is very clean and

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environment friendly fuel. Natural gas is compressed to higher pressure (like 200 Kg/cm<sup>2</sup>) to supply fuel for the automobiles. It is called Compressed Natural Gas (CNG). CNG is playing a very big role to reduce environmental pollution in the city of Dhaka and Chittagong.

Table -1: Bangladesh Natural Gas Cost -2017.

Item	Price per m <sup>3</sup> Taka	Equivalent US\$/m <sup>3</sup> {80 Tk -1 US\$}	Us \$ per mcf	% of Total
Electricity	3.16	0.0395	1.118	40.37
Captive Power	9.62	0.1202	3.40	17.19
Fertilizer*	2.71	0.0338	0.957	7.10
Industry	7.76	0.097	2.74	
Tea Garden	7.42	0.0927	2.62	17.19
Commercial	17.04	0.213	6.032	
CNG**	40.0	0.5	14.16	5.04
Household				13.08
One burner	750 fixed	9.375		
Two burner	800 fixed	10	5.34***	
Meter based	11.20	0.14	3.96	
Total consumption as of 2017-2650 mmscfd				

Source: Titas Gas

\*KAFCO pays a formula gas rate on urea selling price

\*\* Taka 8 per m<sup>3</sup> operator rate is included(2.83 US\$ per mcf)

\*\*\* Estimated based on avg family consumption of 66 m<sup>3</sup>(design being 88 m<sup>3</sup>)

The Table-1 shows the following:

- The lowest gas price is for Fertilizer, Tk 76.56 per mcf and consumes only about 8%
- Gas price for electricity generation is also low, Tk 89.44 per mcf(except captive). It consumes bulk gas about 58%.
- Transport sector pays the highest gas price Tk 1132 per mcf( 14.16 US \$ per mcf). Transport sector consumes only 5%
- Household cooking has two types(a) meter based Tk 316 per mcf and (b) fixed rate Tk 427 per mcf. It consumes 13%.
- The average gas price is Tk 240 per mcf( US \$ 3 per mcf)

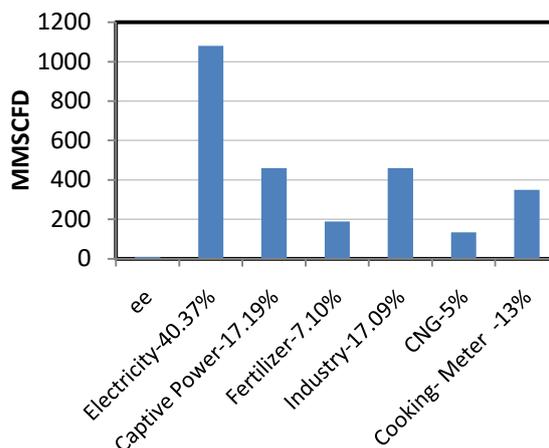


Fig-1: Daily gas consumptions in different sectors

## 2.2: LPG (Liquid Petroleum Gas):

LPG is composed of a mixture of Propane (C<sub>3</sub>H<sub>8</sub>) and Butane (C<sub>4</sub>H<sub>10</sub>). Mostly it is a byproduct from Petroleum refinery .LPG is also processed from natural gas. Like natural gas, it is also a clean fuel and environmental friendly. It is heavier than air.LPG is mostly used for domestic cooking and auto gas. In Bangladesh, LPG is mostly used for cooking and the majority is imported .1 Kg LPG has 0.5 m<sup>3</sup> gas.

LPG is found in all main cities of Bangladesh especially in the north and south where Natural gas has not been supplied through pipes. The import and supply is mainly in the hand of private companies.

Table -2: Bangladesh LPG Cost -2017

Organization	LPG Bottle Size, Kg	Price, Taka	Price Tk per Kg	US \$ per Kg
Bangladesh Petroleum Corporation (BPC)	12.5	700	56	0.70
Bashundhara	12	* 900-1100	75-92	0.93-1.15
Jamuna]	35	*2300-2700	65-77	0.81-0.96
Omera	5	500	100	1.25

\* Variation of price is different in different city-mainly because of the transportation cost

The Table-2 shows the following: For domestic Cooking

- The government supply (BPC) is the lowest cost 56 Taka per Kg. BPC uses 12.5 Kg supply but it is very limited.

- Private companies use 12 kg cylinder as domestic cooking supply and the cost varies from Tk 75 to 92 depending on locations
- The cost of LPG in big capacity cylinders (35 kg) is lower and it is mostly used in hotels and commercial.

### 2.3 Petrol, Octane, Kerosene, Diesel and Furnace oil:

Table -3: Bangladesh Liquid Fuel Cost-2017

Item	Tk /liter	US\$/ liter	Consumption, Quantity in MT	
			2015-16	2016-17
Jet A1			347323	376700
Octane	89	1.11	147557	186911
Petrol	85	1.06	137360	232359
Diesel	65	0.81	3606404	4000044
Kerosene	65	0.81	213685	170993
Furnace oil	42	0.52	711889	806440

Source: BPC website

### 2.4 Electricity:

Table -4: Bangladesh Electricity Cost for different customers-2017

Category A ; Residential	Unit Rate Taka	US\$ Cent
1st Step: From 1 to 75 units	3.80	4.75
2nd Step: From 76 to 200 units	5.14	6.42
3rd Step: From 201 to 300 units	5.36	6.7
4th Step: From 301 to 400 units	5.63	7.03
5th Step: From 401 to 600 units	8.70	10.87
6th Step: From 600 units and above	9.98	12.47
Category-B Agriculture pumping		
Agriculture pumping	3.82	4.77
Category C: Small Industries		
a. Flat rate	7.66	9.57
b. Off peak time	6.90	8.62
c. Peak time	9.24	11.55
Category D: Non Residential (light and Pons)		
	5.22	6.52
Category E :Commercial and Office		
a. Flat Rate	9.80	12.25
b. Off Peak time	8.45	10.67
c. Peak time	11.98	14.97

Source: BDB website

### 2.5 Wood, Dried leaf etc-2017:

Wood, dried leaf and other biomass still constitute the Bangladesh a major fuel requirement (more than 50%) and the village life depends on this type of fuel.

Table -5: Bangladesh Wood Cost per Kg -2017

Fuel Type	Dhaka; Tk per Kg	Jessore, Tk per Kg
Dried wood	7.5/7	5
Wood from rice husk	10	9

## 3. Environment friendly Fuel

The following figure shows the carbon emission for different types of fuel; Pounds of CO<sub>2</sub> emitted per million BTU of energy

Coal (anthracite)	: 228.6
Coal Bituminous	: 205.7
Diesel	: 161.3
Gasoline	: 157.2
Propane	: 139.0
NG	: 117.0

It shows that Natural gas is the most clean producing lowest CO<sub>2</sub>. LPG is close to it. In addition, our Natural Gas do not have S. So burning NG is generally SO<sub>x</sub> and NO<sub>x</sub> free.

## 4. Comparative cost of fuels in Bangladesh-2017

In this section we shall study the present fuel cost in Bangladesh with the same heating value.

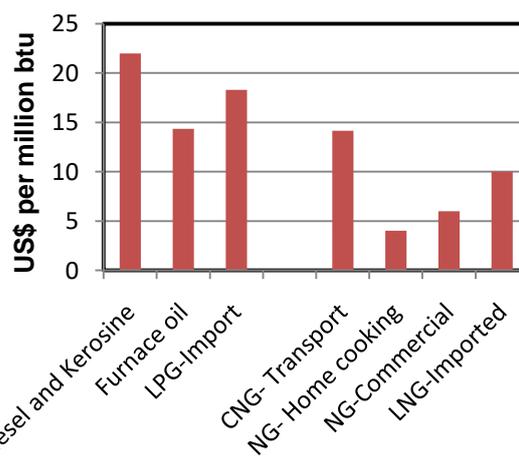


Fig-2: Cost of different fuel with same heating value (or energy value or calorific value)-2017 price

## 5. Fuel International price

The international price for the liquid natural gas varies over months and years following the price of Brent oil. Fig -3 shows that the price has varied between US\$20 to US\$ 10 during the five years 2010--2015. Price deal for LNG is also related to Brent oil.

For example: Bangladesh recent deal for the LNG import from Abu Dhabi is based on the formula:

LNG Price=12.65%\* 3 months avg price of Brent oil+0.50 US \$ per mm BTU. The regasification, gas transport and other FSRU cost to be added here

We have to keep in mind that the global price Fuel fluctuation has to be adjusted on a long term policy of gain and loss market.

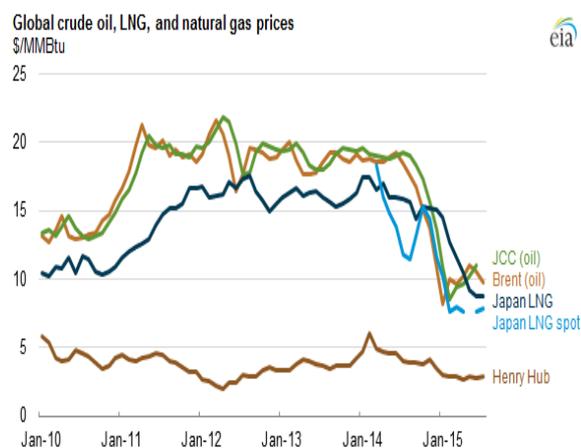


Fig-3: A scenario of global Crude oil, LNG and Natural Gas from 2010--2015

## 6. Issues for Fuel use

Fuel use by the consumers depends on factors like

- Purchasing Power
- Environment factors- avoid air and water pollution
- Price of Fuel
- Technology adapted like Efficiency of burning , Safety, Reliability and users support
- Competitiveness- Especially for electricity price

## 7. LPG Use Issue: Domestic Cooking

- The Private importers are main players for the LPG import and pricing issue. LPG is widely used in Rajshahi, Khulna, Barisal and Rangpur division, where there is no piped supply.
- At present, one medium family requires min 2 cylinders LPG costing about 2200 taka while 2 burners NG present cost 800 taka
- All fuel in Bangladesh eg. Natural gas, Diesel, Octane, Petrol, electricity are regulated and controlled by government except LPG. There is no price control and regulation for LPG.

- Government (BPC) is not playing a role to regulate and control LPG price and its use.

Table -6 Comparing NG and LPG cost for home cooking -2017

	Fixed price-2 burner	Unit sale price	Heat value per unit	Unit price per MJ
Natural Gas	Tk 800	Tk 13.33 per m <sup>3</sup>	39.59 MJ/m <sup>3</sup> *	Tk 0.336
LPG	Tk 1100 for 12 Kg cylinder	Tk 91.66 per Kg	50.80 MJ/Kg	Tk 1.80

The above figure shows LPG about 5 times high than the present NG price

\* A family uses 60 m<sup>3</sup> Natural gas per month in general

## 8. Situation after LNG Import

Imported LNG is a costly fuel but cheaper than imported LPG and other liquid fuels. So, what might be natural gas price after import of LNG.

The present average natural gas price of the home production is about US\$3 per mscf , where as the import price for the same amount will be 10 US\$(2017). So, there will be a mixed average gas price of home production and import- depending on the contributions. A simple estimate case is:

Local NG production: 2500 mmscfd; with avg price 3US\$/ MMBTU

Imported NG: 1000 mmscfd; Price 10 US \$/ MMBTU.

Total NG: 3500 mmscfd

- Price Formula= (Av local price x local production amount+ Import price x import amount )/total gas consumption(local plus import)
- So for a case of 2500 mmscfd local production with 3 US\$ and imported 1000 mmscfd with 10 US\$ per mscf , the Av mix price : 17500/ 3500= 5 US\$
- Now for a balancing, the Gov will decide which sector will provide lower than US\$5 and which sector higher than US\$ 5.

The important sectors for consideration of price adjustment and gas uses are following:

**Home Cooking:** Now the use is 13%of the total gas usage. Present home Cooking price is about 4 US\$. The piped gas supply is in the big cities supporting millions of citizens daily cooking and life.

**CNG- Transport:** Now the use is 5% of the total. The present CNG price is 14 US\$ per MMBTU. This price is much above the home production of average price of US\$3 mscf.

**Power Generation:** Now the use is 58% of the total gas consumption. Its subsidized cost is little over 1 US \$ per mscf.

**Urea Fertilizer:** Now the use is about 8% of the total gas usage and is subsidized. The price is 0.957 US \$ per mscf and is the lowest among all users. Bangladesh requires about 2.5 M ton Urea annually to support its food security -- This is corresponding to 200 mmscfd NG

**Industry:** Its present price is US\$ 2.74 US\$ per mscf and sure to be increased when the mixed natural gas will come.

## 9. Conclusion

Bangladesh domestic natural gas supply is not enough to meet the requirement of economic growth. So, Import is the only option. On the other hand, Bangladesh is a high populous country. The present population density of Bangladesh is around 1,252 people per square kilometer of land and the Dhaka city has a population density is about 45,000 per square kilometer. The neighboring big Indian economic city of Calcutta has a population density of only 24,000 per square kilometer. So, our choice of fuel must meet the requirement of a good air quality to support life of millions.

LNG import is costly but Natural gas (through LNG) is cheaper compare with LPG, Diesel, Furnace oils and Octane. Its environmental treatment is also minimum- in fact is not required.

Considering price, environment and user-friendly, the better option is maximizing the use of natural gas in all sectors -- by mixing home Natural gas with imported LNG. The following sectors are very important:

- **Home Cooking:** The piped natural gas supply should be maintained in cities for home cooking with reasonable price ( a no profit and no subsidy option) .The gas supply to houses should be metered to reduce the usage. For areas, where there is no pipe supply, LPG is an option but its price should have a regulation and control.
- **CNG Vehicles:** At present there is no subsidy and instead Gov receives some additional money. So, the supply should be maintained. However, the price increase -if any - should be below the cost of LPG or other liquid fuel eg Diesel and Petrol.

- **Electric Cars:** To reduce air pollution in the Dhaka city, the electric 3 wheelers (auto rickshaw) and electric cars should be encouraged and allowed to operate.
- **Urea Production:** For food security, Urea Fertilizer Plants within the country should continue operation with a guaranteed supply of natural gas at a reasonable gas price (like US\$ 3 per MMBTU or less). Fertilizer Plants operation should also include measures to optimize the gas usage implementing plant reliability programs. However the fertilizer sector will require some subsidy.
- **Electricity Generation and cost:** Electricity generation is the biggest NG consumption area - at present about 58% of the total and this amount is increasing in coming years. Maintaining reasonable electricity cost is very important to support export economy. Millions of people are employed here especially the garments and other labour intensive sectors-where electricity is one of the major prime mover. Bangladesh electricity cost is already about 8 cents. For the competitiveness with the neighbour countries like India, Vietnam, Pakistan and Chin, the electricity price to the customers should be around 8-10 cent kWh to survive the labour intensive industry and export. Fuel pricing and subsidy -if any should match to it.
- **Energy Efficiency:** The energy utilization efficiencies of Bangladesh industries is low and should be improved with Plant reliability programmes to reduce the national energy consumption as well as improve air pollution levels.
- **Fuel Price Fluctuation:** LNG and LPG price fluctuates like sine waves in international market (varying from 8 to 20<sup>+</sup> US \$ per MMBTU).However, customer requires a yearly constant fuel price. So, a mechanism should be established for a financial funding support.

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