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## Strengthening of the Hydrocarbon Unit in the Energy and Mineral Resources Division (Phase II)

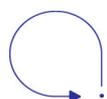
### Petroleum Refining & Marketing (Package # 06)

➔ **Recommendation report  
on Policy and Regulation**



in association with

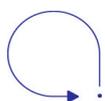




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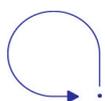
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# Abbreviations

<b>AG</b>	Arabian Gulf
<b>ASTM</b>	American Society for Testing and Materials
<b>BAPEX</b>	Bangladesh Petroleum Exploration & Production Company Limited
<b>BERC</b>	Bangladeshi Energy Regulatory Commission
<b>BFP</b>	Basic Fuel Price
<b>BIWTA</b>	Bangladesh Inland Water Transport Authority
<b>BPC</b>	Bangladesh Petroleum Corporation
<b>BPDB</b>	Bangladesh Power Development Board
<b>BRME</b>	Balancing, Modernizing, Replacing and Expansion
<b>BSC</b>	Bangladesh Shipping Corporation
<b>BSTI</b>	Bangladesh Standards and Testing Institute
<b>CCGT</b>	Combined-Cycle Gas Turbines
<b>CN</b>	Cetane number
<b>CPA</b>	Chittagong Port Authority
<b>CNG</b>	Compressed Natural Gas
<b>EPOL</b>	Emergency Preparedness Offshore Liaison
<b>ERL</b>	Eastern Refinery Limited
<b>FO</b>	Fuel oil
<b>FOB</b>	Free on Board
<b>FY</b>	Financial Year
<b>GDP</b>	Gross Domestic Product
<b>GtG</b>	Government to government
<b>HAZOP</b>	Hazard Operational Analysis
<b>HOBC</b>	High Octane Benzine Component
<b>IOC</b>	International Oil Company
<b>IP</b>	Institute of Petroleum
<b>JOCL</b>	Jamuna Oil Company Ltd
<b>Km</b>	Kilometer
<b>KAD</b>	Dhaka Airport Depot
<b>KPCL</b>	Karnataka Power Corporation Limited

<b>LNG</b>	Liquidized Natural Gas
<b>LPG</b>	Liquid Petroleum Gas
<b>Mcf</b>	Thousand Cubic Feet
<b>M&amp;D</b>	Marketing and Distribution
<b>MI</b>	Main Marketing Installations at Chittagong
<b>mmBTU</b>	Million British Thermal Unit
<b>Mmscft</b>	million standard cubic feet
<b>MPL</b>	Meghna Petroleum Ltd
<b>MS</b>	Motor Spirit
<b>MT</b>	Metric Ton
<b>MW</b>	Mega Watt
<b>NEP</b>	National Energy Policy
<b>PDB</b>	Power Development Board
<b>POCL</b>	Padma Oil Company
<b>PPD</b>	Packed point dealers
<b>ppm</b>	parts per million (1/1.000.000)
<b>PSDP</b>	Power Sector Development Program
<b>R&amp;D</b>	Research and Development
<b>SPM</b>	Single Mooring Point
<b>UOP</b>	Universal Oil Products
<b>USD</b>	United States Dollar
<b>VOC</b>	Volatile Organic Compound



# Policy Executive Summary

The Energy sector plays a vital role in the development of the economy of a country and welfare of its people.

The total energy need of Bangladesh is currently met with supplies from different sources like natural gas by far the largest contributor, coal which is insignificant due to restrictions in mining policy and then for the future a so important reliance on liquid petroleum products, beside different renewable energy sources such as water, wind and biomass.

Energy is a vital input into production and this means that if Bangladesh is to move to the higher economic growth rate that is now feasible, it must ensure reliable availability of energy, particularly electric power and petroleum products, at internationally competitive prices. The country cannot compete effectively in world markets unless these critical energy inputs are available in adequate quantities and at appropriate prices.

The present energy scenario, as defined in the 1996 National Energy Policy (NEP), is no longer satisfactory.

The situation has drastically changed from the time the energy policy was approved (1996) where it was mentioned “replace oil imports by gas as far as possible” as one of the objectives. This may now be replaced with “use imported petroleum fuels, where natural gas or better alternative energy source is not available”.

Encouragement in use of Compressed Natural Gas (CNG) in the transport sector has so far reduced the load on imported liquid petroleum fuels (gasoline, diesel) besides helping improve the air quality/environment. The government’s policy has proved successful, leading to a large and fast development of CNG-run vehicles. However, the price of CNG has been set at a very low price, not reflecting the true cost. This should at least be equal or at parity to international price levels.

Policy has to stimulate the importation of Liquid Natural Gas (LNG) and Liquid Petroleum Gas (LPG) to compensate for future depletion of own gas production facilities for critical users as household cooking, CNG transport sector and Power generation.

In this same context there is a large gap between the generating cost of gas and oil-based electricity and its selling price in the domestic market. We can call this a heavy subsidy allocated to electricity consumers who are not asked to pay the real generating cost which will lead to inefficient use of energy. As a result Power Development Board (PDB) is incurring heavy financial losses which are not sustainable in the long term. Policy needs to be adjusted to reflect true market parity.

Energy audits should be undertaken at each main gas and oil consumer in the power generation and industrial sectors, so as to evaluate the amount of gas that could be saved by stimulation of new efficient installation of Combined Heat Power units, the cost of the investment required to switch to liquid fuel(s), and the benefit generated by making more gas available for other usage.

The country will become more dependent on oil for its domestic needs, irregardless of gas being supplied from decreasing own production or LNG imports because of the expected increase in oil demand to over 6 million tons/year within just the next 5 years.

Refined products are now imported to meet the deficit beyond those obtained from Eastern Refinery Limited (ERL) refinery and some quantities obtained from local gas fields. But question remains whether it is better for national energy security, economic and other considerations to be so much dependent on import of products from other countries or to increase its local refining capacity. Policy should reflect this more clearly and be acted upon imminently. There is the need to discuss the policy and regulations framework which will be of importance to the choice of refinery configuration and trading strategy underlying the sustainability of the project.

The key policy issues are:

- Future Pricing of petroleum products and gas; impact of subsidies/taxes and other deviations from free market pricing policy;
- The application of taxes and subsidies on refined products and gas;
- Private company initiatives to participate unhindered in all petroleum products supplies and including investments in refinery and marketing facilities;
- Mandatory minimum and maximum petroleum product specification limits for regional and environmental reasons meeting present situation;
- Future private imports of alternative petroleum products to balance product demand (including LPG, LNG).

With these refinery related issues there has to be policy consensus on the following:

- Oil product and gas prices need to reflect true international market price levels to provide a sustainable demand and supply provision. Set a minimum domestic price monthly at least equal to, or above the market parity price (based on Platts Singapore and Arabian Gulf (AG)). Described is a Basic Fuel Price (BFP) pricing methodology which should be used which is consistent and flexible.
- Imposition of Taxes in particular on transport/motor fuels is a deterrent for inefficiencies in energy use, and also income to the State for project financing.
- Subsidies need to be targeted to specific user categories and be identified critically. Grant subsidies only to those end user groups in need, and stay clearly targeted for these select groups only.
- Private sector involvement in the oil supply will stimulate competition and lower prices, and will also be capable to provide capital for the oil industry infrastructure. Allow private parties to initiate, or participate in energy projects.
- Product qualities need to reflect regional standards and provide long term welfare.
- Imports activity of energy needs to be accessible for all interested parties to participate both for direct supply to consumers and for the energy infrastructure.

The government has kept full control, till now, over the import, marketing and distribution of the main products like gasoline, kerosene, diesel and jet fuel. Central coordination has advantages with regard to knowledge and national security control, but the private sector is also a source of capital for development of infrastructure. Also private sector involvement will increase efficiency and competition in a free market and ensure a better price to the consumer. The private sector will under right conditions provide capital, competition, knowledge and flexibility for the oil products' supply. It is an important part for the new policy to be focussed on private enterprise participation in the development and execution of oil product supply to the market.

Assurance of quality of fuel products as per approved specifications is very important for unified standards in petroleum product consumption for security of smooth running of the engines and proper burning of the fuels which gives desired output as well as help control environmental pollution. The standards, specifications of oil products needs to be modified /

improved by the relevant authority (Bangladesh Standards and Testing Institute (BSTI)) to meet changing demand of fuel, engines and environmental consideration. Proper systems are to be there to ensure compliance of such standards and specifications. Products-related environmental protection through Health Safety and Environment is currently only partly in place and needs more direction. It is recommended to set up a plan to decrease the maximum allowable sulphur content for transport fuels Diesel and Gasoline in Bangladesh to 350 ppm according to majority of the market in Southeast Asia and for inland heavy fuel oils to maximum 2 % sulphur. The technical recommendations regarding upgrading the existing refinery capacities are also based on this figure.

There does not appear to be specific recommendations to be made in terms of mandatory storage capacity, in respect of operating and strategic storage. Marketing and Distribution (M&D) operators are well aware of the constraints that shape their activity, in particular in respect of the weaknesses of the products transportation system and the seasonal variation of the demand. However, a minimum operating storage capacity of at least 15 days sales equivalent consumption should be set regionally as depot stocks. Particular attention should be paid to such key aspects as definition of the notion of 'strategic stocks', stored in the country near or at the refinery to allow 40 or better to consider 60 days consumption in terms of a total of crude oil and products operated by the M&D companies, large consumers like power generators and of course the refinery itself with the largest storage facilities.

# 1. Introduction

Energy sector plays a vital role in the development of the economy of a country and welfare of its people. Though per capita consumption of commercial energy and electricity in Bangladesh is one of the lowest among the developing countries, the demand is gradually increasing with growth of Gross Domestic Product (GDP) at around 6% in recent years. The country must ensure reliable availability of energy, particularly electric power, gas and petroleum products in adequate quantities and at appropriate prices to move to the higher growth rate that is now feasible. However, the country is not able to meet the growing energy demand, which is now restricting the economic development. To date The National Energy Policy 1996 is still valid though several drafts were prepared to update it for meeting the changed situation; however, none has been approved as yet.

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## 1.1 Energy Background

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Natural gas is the principal indigenous non-renewable primary energy source of the country supplying about 70% of the country's commercial energy till recently. But increase of its production is lagging behind its increased demand in various sectors, which has resulted in shortfall, at present, of about 500 million standard cubic feet (MMCFT). New connections including commercial, industrial, domestic consumers, etc. are withheld, as it is not possible to supply required gas to existing users. Even fertilizer factories are forced to be kept shut to reduce gas demand so as to make the saved gas available to other priority areas, mainly to power plants. The government needs to implement urgent steps to increase gas production, and examine import of LNG with storage, re-gasification plant and connecting pipeline to existing gas network. International price of gas is relatively cheap compared to oil (at market prices) but investment is substantial.

The country is facing acute shortage and unreliable supply of electrical energy. Currently load shedding is running at about 1,000 MW; new connections to different users including households are pending. Non-addition of new power plants to meet increasing demand, aging existing plants with frequent breakdowns and poor efficiency coupled with short supply of natural gas to power plants are considered to be the main reasons for such a situation. It may be noted that until recently, about 83% of the power plants were based on natural gas as fuel source, but it is on decline.

Regarding renewable energy, the Kaptai hydroelectric Power Station is still the only one of its type, meeting only about 3.9% of the country's electricity demand. The number of solar power units in use is increasing to some extent, but its overall impact on the energy needs of the country is small. Energy supply from wind power is negligible, as is biogas. Nevertheless, there is need to encourage such areas of renewable energy sources for development in contributing to the national energy need.

Coal is a prospective source of commercial energy, having vast deposits discovered in the northern part of the country. However, selection of the type of mining to be followed for its recovery associated with the environmental issues, displacement of habitations, loss of agricultural land, etc. has restricted, until now, the use of coal in meeting energy need of the country. Till now, only one power station based on coal from Barapukuria field is in operation with a production capacity of 250 MW. Steps for establishing a nuclear power plant at Rooppur has been given a fresh push, but target date for its implementation is wide open.

With the shortage of natural gas and acute load shedding in electricity supply, the source of commercial energy is shifting to liquid petroleum fuels. Bangladesh Power Development Board (BPDB) is implementing its Power Sector Development Program (PSDP) including:

- A short term, emergency rental program to add about 1,400 MW within 2011. Although more expensive, such rental station will prevent black outs and thereby a more or less continued industrial growth;
- Further long term programs to build modern power generation facilities, with good efficiencies, leading to additional generation of about 8,000 MW within 2015;
- To build the required infrastructure necessary to supply these generators, e.g. fuel tanks.

Many of these power plants are going to be based on liquid fuels e.g. diesel and fuel oil (about 1,400 MW on liquid fuels only and about 1,750 MW on gas or liquid fuels, i.e. if gas supply is not sufficient, liquid fuels will be the alternative) during the period 2010 to 2014.

Load on liquid petroleum fuels is also expected to rise due to restrictions / limitation on CNG availability for transport sector.

Considering such factors, the demand of petroleum products in the country is expected to rise very fast, from 4.05 million ton during Financial Year (FY) 2009-10 to 7.8 million ton in 2015, 10.5 million ton in 2020 and 18.5 million ton in 2030. Till recently liquid fuels accounted for about 22% of the commercial energy consumed in the country, which is expected to rise very fast.

There being no crude oil available locally, except some condensates from local gas fields. The country having only one refinery with a design capacity to treat 1.5 million tons of crude oil a year, there is going to be tremendous pressure on the financial sector as well as other areas involving import of refined products with high prices on the international market, their reception, storage, transportation, etc. Diesel and fuel oil are the two petroleum products being used as fuel for new power plants spread throughout the country with limitations in storage and transportation. Bangladesh Petroleum Corporation (BPC) with its subsidiary companies are going ahead to build up necessary infrastructure, additional storage to meet the requirements.

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## 1.2 Towards a New Policy

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Energy is a vital input into production and this means that if Bangladesh is to move to the higher economic growth rate that is now feasible, it must ensure reliable availability of energy, particularly electric power and petroleum products, at internationally competitive prices. The country cannot compete effectively in world markets unless these critical energy inputs are available in adequate quantities and at appropriate prices.

The energy scenario, as defined in the 1996 National Energy Policy, is no longer satisfactory. The power supply position prevailing in the country is characterised by persistent shortages and unreliability and is also very inefficient due to old technology equipment. There is also concern about the position regarding petroleum products. Bangladesh depends to the extent of 70 % on gas, some coal and 22 % imported oil, and this naturally raises issues about energy security. These concerns have been exacerbated by recent movements in international oil and gas prices. Electricity is domestically produced but production is by far too low to meet all demand, and its supply depends upon availability of gas, diesel and furnace oil, and other exploitation of hydro, solar, wind power sources and the possibility for expansion into nuclear power.

There are constraints affecting each source.

Achieving an efficient configuration of the various forms of energy requires consistency in the policies governing each sector and consistency in the pricing of different types of energy. There is also a need to clarity in the direction in which to move in aspects like energy security, research and development, addressing environmental concerns, energy conservation, etc. To address these issues in an integrated manner, the government has started a comprehensive review and this study report presents recommendations in this respect.

In respect of power generation, the Government has launched the emergency programme mentioned above.

The Government should also lead into a thorough examination to build a port for Liquid Natural Gas (LNG) imports, with all gas infrastructure; re-gasification plant, pipeline manifolds, connections to the domestic system, etc. Gas is relative cheap compared to oil (at market prices) but investment is substantial.

Therefore the alternative will be oil fired power plants. With increased refinery output, it will be a far easier and less costly way to provide the energy for electricity generation.

Faced with such a tough and challenging situation, the policies, rules, and regulations prevailing in the country's energy sector needs to be thoroughly examined and necessary amendments / modifications / additions are to be incorporated and implemented in the short term to cope with these changing conditions (from the situations prevailing at the time of preparing the National Energy Policy, 1996) in the interest of national development and well-being of the people.

## 2. Energy Resources

The total energy need of the country is currently met with supplies from different sources like natural gas, coal, liquid petroleum products, and different renewable energy sources besides biomass – which still forms the main source of energy especially in the rural areas. Among the commercial energy sources, most appropriate and economically suitable ones are to be chosen and put into practice in right areas to meet the challenging situation. Brief analysis on each source and suggested steps to be taken are mentioned in the following sections.

### 2.1 Natural Gas

Natural gas remains by far the main source of commercial energy in Bangladesh meeting about 70% of total requirement. To meet increasing demand of electricity generation and in absence of suitable alternatives, natural gas has become the main energy source for power generation (about 83%). Due to low end user prices fixed by the authority (for industry, it is about 15% of fuel oil price), being clean and easy to handle, natural gas use became very much attractive compared to other fuels. But steps for its increased exploration/production lagged behind the demand trend. The local exploration authority Bangladesh Petroleum Exploration & Production Company Limited (BAPEX) under Petrobangla, has limitations in respect of equipment, finance, manpower to go for intensive exploration. Share in the gas sale price is too low for the producing company to generate sufficient return. Buying price of gas from the International Oil Companies (IOCs) under production sharing contract is considered low compared to regional gas price. Such factors are going against the funding of large scale investments required for exploration and development of new fields, as well as increasing present production capacity.

Major gas transmission pipelines of the country are World Bank- or ADB-funded. It is said, installation of some additional transmission lines, compressors would improve the gas supply situation even with existing production wells. Recently, Petrobangla has initiated steps for importing LNG from Qatar with floating storage, re-gasification plant and connecting pipeline to existing gas network, which is expected to be costly, about \$10–12 per Thousand Cubic Feet (Mcf). However, LNG import is an option to meet the energy need if nothing is available locally at cheaper rate. Import of Natural Gas from neighbouring country Myanmar could be a very good option.

Encouragement in use of Compressed Natural Gas (CNG) in transport sector has reduced load on imported liquid petroleum fuels (gasoline, diesel) besides helping improve the air quality/environment, in particular in the already much congested urban areas. The government's policy has proved successful, leading to a large and fast development of CNG-run vehicles, in particular private cars and 'baby-taxis' (three-wheelers), which now account for about one-third of the automotive stock.

In pursuing such bold policy the government has rightly followed a general principle, based on experience in other gas countries, which shows that CNG requires a strong political will, hence public financial support, to develop and maintain over time. However, the price of CNG has been set at a very low price, which makes it ultimately fail to meet overall national interest. As a result of severe gas shortage, the government has recently embarked on a drastic counter-policy aiming at limiting the use and further development of CNG, including a ban on new CNG filling stations and the interdiction to dispense CNG during peak day demand, i.e. between 3 pm (now 5 pm) and 9 pm, in order to allocate as much gas as possible to supply power stations.

The market-oriented economic theory is not opposed to subsidies in general, in particular in developing economies, provided they are appropriately targeted. In the case of energy products, a general rule is that subsidies may be used primarily to (a) help operators develop infrastructures, and (b) help consumers to switch to the desired product. They are therefore used as 'one-time payments'; their amount can easily be assessed and monitored under timed programmes.

Conversely, applying subsidies to the product itself creates an endless drain on the national budget, which expands without control as product usage develops. While such issue can be to some extent harnessed in rich oil and gas countries that are able to export a substantial part of their production, the situation becomes rapidly unbearable in countries with limited resources, which is the case of (inter alia) Bangladesh. In addition, subsidising the product itself does not allow the government to efficiently allocate the subsidies to those who are really in need and should benefit from them. In the case of automotive fuels, subsidies go without discrimination to all vehicles owners, irrespective of their real ability to afford paying the full economic cost of the product.

In addition, should subsidising CNG (as a product) remain the preferred policy chosen by the government, then the subsidies model should be corrected on two counts:

- The gap between the price of CNG and that of the second-best option (here gasoline) should remain reasonable and avoid granting windfall profit to CNG users. In Bangladesh, even since the recent price hike on both CNG (now at Tk25/cubic meter) and gasoline (now at Tk76 and Tk79/litre for Motor Spirit (MS) and High Octane Benzine Component (HOBC), respectively), CNG remains about 4 times cheaper than gasoline on a calorific value basis. Such large gap allows CNG users to recover the cost of the CNG kit in just about a few months, allowing them to then rely on heavily subsidised CNG until the end of the technical life of their vehicle. A pay-out time of about three years looks more in line with the generally admitted decision-making car owners, and would certainly prove sufficient to generate about the same level of attractiveness of CNG-run against gasoline-run vehicles.
- The end-user price of CNG should be set at least above its economic delivery cost, i.e. the sum of production, transmission, distribution and marketing the gas. In those market-oriented economies that subsidised CNG, the price of CNG is generally set at a level that enables CNG operators to recover their costs and make a reasonable profit. The 'subsidy' is in fact the acceptance, by the government, to perceive no or lower taxes (usually in the form of excise tax) levied on the selling price of CNG as compared to the taxes applied to liquid fuels. At Tk25/cubic meter (about 10 USD/ Million British Thermal Unit (mmbtu)) the end-user (pump) price is presumably lower than its real economic delivery cost at the filling station. We recommend that an in-depth economic analysis of the real delivery cost of CNG be conducted (or updated) to determine the desired minimum selling price of the gas for vehicles.

The government may also reconsider its current policy of extending the gas pipelines networks aimed at providing natural gas supply to new areas such as the Northwest and Southwest, in order to avoid new investment as well as saving such gas volumes for more useful purposes within the existing network.

Fertilizers are the second largest sector consuming about 17% of total natural gas. Besides using the gas as raw material, 25 – 35% of it is being used as fuel in power, steam generation etc. Opting for alternative fuel for such purpose could save such a big quantity of gas for use in other priority areas avoiding recent trend of keeping some fertilizer factories shut. Besides, gas consumption per unit production of fertilizer may be checked and necessary remedial steps taken where it is needed, at the earliest.

Use of natural gas for domestic cooking, hotels, other commercial uses is another area to be reconsidered. Existing price for such use and measurement of the used quantity are the other point to be reviewed. Use of LPG as an alternative fuel especially for affluent populations seems to be a right step.

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## **2.2 Coal**

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Bangladesh has a substantial reserves of high quality coal (high heating value, low sulphur, low ash content), mostly located in the North-Western part of the country (Rangpur-Dinajpur), involving several fields. But extraction of the coal has been limited till now, because of delay in finalizing the type of mining to be followed (open-pit vs. underground mining, underground coal gasification, coal-bed methane). This coal could play a very vital role and supply a good portion of commercial energy for sectors like power generation, industry, brickfields, etc. Specific generation cost of electricity based on coal could also be cheaper (reportedly within Tk. 4/-per kWh). Policies related to coal mining including the relocation of the affected population, environmental issues need to be finalized early to have the coal sector play its desired role in the energy mix for the country.

Power plants based on imported coal could also be set up in the coastal areas, giving necessary attention to the quality of coal to be used, the ash content and its disposal and other environmental issues. The government is planning to set up large coal-based power plants near Mongla and Chittagong. However, these ports have severe navigability constraints that prevent seagoing vessels from directly anchoring at port facilities – an issue also faced by crude oil ships. Anchoring mother vessels in deep sea and transshipments would require a huge fleet of lightering vessels, which would seriously complicate the reception and handling of the large quantities of coal required by big-size power plants, and substantially increase production cost.

Coal operation is currently governed by the Mines and Mineral Rules (MMR) passed in 1968 and amended in 1995. However, some vital elements are missing in the MMR. A draft Coal Policy 2010, which aims to address such key issues as coal reserve, new coal deposit discovery, environmental preservation and control of environmental pollution is under review, but coal specialists notice that some additional work needs to be done in the drafting of the Coal Policy document so as to provide operators with the operational guidelines required to sign sound and fair exploration and operating licenses.

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## **2.3 Hydroelectric Power**

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Bangladesh being mostly plain land, scope of large scale hydroelectricity production is limited here after the Kaptai project. But small scale plants can be set up to meet local demand. Import of electricity produced / to be produced in neighbouring countries like Bhutan, Nepal is a very attractive option. Besides reducing dependence on depleting natural gas supply and imported petroleum fuel oil, this option would go to a great extent in meeting the power demand of the country. Political understanding, besides the technical and financial matters, is the area to be dealt with.

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## **2.4 Nuclear Power**

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This is a big item and if it can be implemented would go a long way in meeting future power demand of the country. Further progress, within reasonable time, is needed to be made on the

steps already taken for setting up the long talked about nuclear power plant at Rooppur for which land was acquired during pre-independence period. But all modern safety aspects are to be taken care of to avoid any accident/disaster in a thickly populated country like Bangladesh, to avoid any such accidents / disasters that happened in Charnabyl and Japan.

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## **2.5 Renewable Energy Sources**

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Use of solar power in remote rural areas is increasing, thanks to different organizations' endeavour. Recent government encouragement for its extension may be further strengthened, including giving incentives for local production/assembly of solar panels & related items. Large organizations/effluent people may be encouraged or even some regulatory measures should be taken to install solar panels on high-rise / commercial buildings though it may appear to be very costly.

Use of some energy from wind power and tidal force especially in the coastal areas may be encouraged. Small scale localized units may also be helpful for small users which would ultimately be helpful to the nation.

More use of biogas from household garbage, cow-dung, city area solid waste, etc. may be encouraged. City corporations/ authorities need to come forward in setting up such plants to produce energy and also improve the environment. Encouragement including financial supports would help people to go for such renewable sources of energy making them more self- reliant especially in the rural areas, where supply of electricity, pipe gas etc. are difficult and costly to avail.

## 3. Petroleum Products

### 3.1 Liquid Fuels

Transport sector and other areas like agriculture, industry, households especially in the rural areas, was and will remain dependent in future, on use of liquid fuels (in addition to biomass), which are basically all imported except some condensates available from local gas fields. Share of liquid fuels, till recently, was about 22% of all commercial energy demand of the country. But with growing shortage of natural gas in generation of electricity, the authorities are forced to go for liquid petroleum fuels like diesel and furnace oil (fuel oil) as an alternative source of energy for new power plants. This will result in higher share of the petroleum fuels for electricity generation, rising from 308,000 tons consumed in FY 2009-10 to about 3.1 million tons by 2015, compared with total consumption of petroleum products, rising from 4.05 million tons during FY 2009-10 to an estimated 7.4 million tons in 2015.

The situation has drastically changed from the time the present energy policy was approved (1996) where it was mentioned “replace oil imports by gas as far as possible.” as one of the objectives. This may now be replaced with “use imported petroleum fuels, where natural gas or better alternative energy source is not available. Fuel oil, being the cheapest, should be the first choice for power plants”.

This very fast rise in consumption of liquid fuels, being imported at high international market price, is going to have very high load on national exchanger besides infrastructure, storage, distribution, etc. It may be considered that the sooner alternative fuels are made available, preferably indigenous, at least for electric power generation, to replace diesel and furnace oil, the better. Also, emphasis needs to be given on the efficiency of power plants, both gas and oil fired. Fuel consumption, in any form, can be drastically reduced by having modern efficient plants. It can be said that production of electricity can be doubled using same quantity of fuel if older engines / plants are replaced with modern efficient plants having double the efficiency. With setting up of large and efficient power plants meeting the country's demand, PDB may discard the 3 year contract-based rental diesel power plants first where the generation cost is very high (about Tk 14/- per kWh) compared to the selling price of electricity in Bangladesh. These quick rental plants had served well to meet the urgent need of the sector, but many of these have installed small engines (for example 100 units used in a plant to produce 49 MW). Such simple engines generally have lower efficiency, consume large quantity of costly imported fuel, compared to modern power plants.

However, it should be acknowledged that the gap between the generating cost of oil-based electricity and its selling price in the domestic market is not caused by high oil price (the price of oil is what it is), but rather by the heavy subsidy allocated to electricity consumers who are not asked to pay the real generating cost. As a result PDB is incurring heavy financial losses because of subsidies, exactly in the same fashion as BPC is overloaded with losses generated by the subsidy granted to the consumers of most oil products.

In the (probable) event that no substantial additional gas resources (whether new reserves or workover in existing fields) would be discovered or implemented, Bangladesh has to resolve to ever increasingly rely on imported energy sources, most likely in the form of oil products, at least over the short and medium term. The only domestic resource that could be tapped in the medium term is coal in the North Bengal area. Renewable energy (solar and wind) is certainly much talked about in the current days, but it cannot be considered as a suitable option for bulk power generation for the time being due to (a) the average small size of the projects

which make them more suitable as de-centralised power, and (b) even higher costs compared to oil, both in terms of investment and operation.

Indeed, the secure development of power generation requires that two policies be implemented in parallel:

A financial policy, whereby subsidies on the wholesale price of electricity are progressively lifted in order to (a) decrease the drain on the national budget caused by the subsidies, and (b) enable PDB to implement the much needed revamping or replacement of older, inefficient power stations together with the construction of new, more efficient stations such as combined-cycle gas turbines (CCGT);

As a technical policy, the most inefficient power stations, (sometimes with thermal efficiency as low as 25-28 % ), may shift from natural gas to fuel oil, in order to re-allocate as much gas as possible to more efficient CCGT plants, existing or coming soon.

## 3.2 LPG

Liquefied petroleum gas (LPG) is a good substitute for natural gas in many areas including household cooking, in hotels and restaurants, transport, etc. Besides its production at local refinery and at Kailashtila plant from natural gas liquids (NGL) – both sources combined producing from 15,000 to 22,000 thousand tons per year in total – several (currently four) private sector companies are importing LPG in bulk quantities (about 46,000 tons in 2010), marketing it in 5.5, 12 and 12.5 kg bottles/cylinders for domestic use and up to 45 kg cylinders for commercial use. Some vehicles in the western part of the country, where there is no supply of natural gas/CNG, are using LPG as fuel in place of gasoline. But with high price of crude oil and petroleum products in the international market, LPG price becomes very high compared to locally available natural gas, whether piped gas or CNG. For example, an average household requiring one and a half cylinders every month must spend about Tk 1,800/- per month compared to a flat Tk 450/- for piped natural gas.

There again, the development of the LPG activity and the very access of the population to domestic energy are now hampered by the subsidy policy. During the time when natural gas was (or was considered to be) easily available and cheap, the government had launched a massive gasification policy in many cities, to provide households with piped gas for cooking and, to a more limited extent, water heating. As a result there are now about 1.5 million domestic piped gas users across Bangladesh who account for about 12% of the total gas demand. Subsidies are given in two ways: (a) in selling gas at a price below economic cost, and (b) in charging a monthly flat price, irrespective of the real consumption. Indeed, the latter presents some strong positive aspects, in the form of substantial savings on both investment cost (no meters) and operating cost (no meter-reading, easier book-keeping, billing and collecting). However, flat prices unfortunately generate two adverse effects: gas waste (real consumption disconnected from price paid) and pilferage (several households connected to gas grid through a single user, hence single contract and bill).

As for other consumers, gas shortage (both in terms of reduced volumes available and constrained transmission and distribution capacity) leads to less gas available to households. The government has taken, and recently confirmed<sup>1</sup>, several measures to mitigate the consequences of gas shortage, including the ban on fresh piped gas connections to households, and a new policy aiming to promote LPG and develop both its supply and market base.

Implementation of Balancing, Modernizing, Replacing and Expansion (BMRE) of ERL refinery (increasing its capacity) and/or setting up a new refinery will certainly increase local LPG production substantially; steps for increasing LPG production from NGL also will also be more beneficial. However, the large upside potential market for LPG will by far exceed the amount of

<sup>1</sup> Press conference of the Energy Secretary Mr. Mesbah Uddin, 5 April 2011

domestically produced LPG, even once a new refinery is on stream. A new policy should be devised and implemented to facilitate and accompany the expected development of LPG.

As mentioned above, the end user price of LPG is significantly higher than that of piped gas. Successfully shifting from piped gas to LPG in those areas where both fuels are available, requires that a true competitive environment be implemented. This implies that subsidies on gas are lifted and/or re-directed towards those really in need. A second, complementary measure would be to reduce the level of taxes and duties on imported LPG, which currently incurs 24% import duty, in the form of customs duty (5%), VAT (15%), Advance Income Tax – AIT (3%) and Pre-Shipment Inspection – PSI (1%). Both measures are learnt to be under consideration at government level.

A third policy measure is much needed. Private operators (who procure LPG entirely from the international market) set freely the transfer price of the product to their dealers (who add their retail margin and set end user prices). Conversely, the end-user price of LPG produced in Bangladesh and sold by BPC's M&D subsidiaries is fixed by government authorities, much like liquid products. As the price of 'domestic' LPG is not meant to be subsidised there is some connection between the international market price and the administered price. However, recent history shows that there may be a substantial price gap between private and BPC companies, in particular when the international price moves rapidly. In April 2011 such gap was about Tk500 for a standard 12 / 12.5 kg cylinder (Tk1,200 vs. Tk700). Such gap strongly distorts the market as price differential generates a strong pressure of the demand for the cheaper cylinders, to the expense of private operators. Shortage of 'domestic' LPG is worsened by a specific allocation system whereby numerous public institutions are entitled to receive a given number of cylinders at concessional price, whatever the volume of the demand of individuals. Price distortions compound to develop black market, which results in 'domestic' LPG being actually sold at a price close the 'international' price set by private operators.

The dual pricing system has no justification and should be abandoned.

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### **3.3 Gas Field Condensates**

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A good quantity of condensates, about 250,000 tons, are available annually from different gas producing fields, mostly in north-eastern part of the country, with the quality, composition, and quantity varying from field to field. Most of these consist of light gasoline, with the balance in the form of some kerosene and diesel. Some of the fields have set up fractionation plants to separate the components, which adds to their financial revenue. The government has also given permission to some private sector companies to set up small fractionation plants at different areas, and more are in process. Earlier, major portion of the condensates used to be sent to ERL where it was blended with crude oil for processing / upgrading to get more valuable products.

In a country having no crude oil of its own, such a quantity of condensates is very valuable for the energy sector. Policy for proper processing and upgrading of the condensates in a refinery plant for its best valorisation should be there at the earliest instead of going for piece meal solutions like setting up so many simple fractionating plants at so many locations. Besides, questions related to ensuring product quality from such plants, adulteration of products remain there.

## 4. Efficiency, Energy Conservation

Many power plants in the country are very old and their efficiency (percentage of electrical energy converted from fuel energy) is low, in some cases as low as 20 – 25%. Simple modern plants have efficiency in the range of 36 – 40% or even higher. A modern combined cycle power plant having gas turbine at the first step and then thermal unit producing steam using exhaust gas, which actuate a turbine to produce electricity, may have efficiency of 50 – 55%. Scope of utilizing lower temperature heat energy would increase the efficiency level further. A power plant having 60% efficiency will use one-third fuel compared to the one with 20% efficiency and half the fuel compared to a plant having efficiency of 30%. This saving in fuel quantity / cost would enable the country to get 2-3 times more electricity utilizing the same quantity of fuel. Of course, cost of such plant is higher, but the benefit thus obtained pays off. As in current situation, with country having shortage of natural gas, electricity, and high import cost of liquid fuels, the authorities, as a matter of policy, should go for modern combined cycle power plants with higher efficiency. Also, the scope of partial replacements of old plants (may be the engine, turbine or boiler), may be examined to improve the overall performance, reduce fuel consumption and have better economics.

All power plants, industries and energy users should be aware of the need to conserve energy, improve the energy utilization process considering their own economics as well as the national interest. Special programs, advertisements, seminars involving such areas may be extensively arranged to make the people aware of this subject.

Transport sector was, until FY 2009-10, the main user of liquid fuels in the country. Improvement of mass transport system like railway, large river transports for long and medium distances; metros, shuttle trains, and more public buses in the city areas would save a lot of fuel besides reducing other problems like traffic congestions, air pollution, wastage of manpower etc.

## 5. Energy Audits

As mentioned earlier in this report, poor thermal inefficiency, in particular at old power stations and factories, contributes significantly to the waste of energy and energy shortage (especially gas). Several power stations operate at efficiency levels ranging from 25 to 30%, while the efficiency of modern combined-cycle gas turbines is commonly twice such value. The same goes for very old outdated fertiliser plants where efficiency is also very low. In addition, significant amounts of gas is being burnt in areas of fertiliser factories in the country where it brings no value addition and could technically be replaced by liquid fuels (generally fuel oil), which would allow saved gas to be re-directed towards applications where gas has no substitute, such as CCGT or feedstock for urea production. This, for instance, is the case of steam-turbine power plants and thermal (non feedstock) applications in urea plants that can technically run on liquid fuels.

Energy audits should be undertaken at each main gas consumer in the power generation and industrial sectors, so as to evaluate the amount of gas that could be saved, the cost of the investment required to switch to liquid fuel(s), and the benefit generated by making more gas available for other usage.

There should be a system of energy audit in large organizations/ industries to check the utilization of the energy they consume in their own interest. Besides, the government should fix designated authority to check proper utilization of such energy. A minimum standard is to be fixed by the authority, in consultation with concerned group of users and expert in the field, to be followed by each category of users. Power plants of different types and capacities, different types of industries etc. are also to have their own target to be achieved. Performance of existing plants, industries may be checked and if actual figures are below the acceptable value, the concerned users are to be notified of it and advised to improve their system. The country should not allow wastage of valuable energy by individuals/ groups even if they can afford it.

The system may be introduced initially with big consumers, gradually going down the order and cover various forms of energy including electricity, gas and petroleum products. Companies / organizations intending to set up plants / industries should be required to specify their planned consumption level and the proposed efficiency of their plant / equipment they would maintain which should be acceptable as per approved standard fixed by the designated authority. The regulatory authority, the Bangladeshi Energy Regulatory Commission (BERC) should come forward, with sufficient resources, to take up this responsibility. This would be necessary to get permission for setting up the plant /industry and getting the energy supply. Failure to achieve and maintain the minimum standard would be punishable.

Introduction of such a system would enable the country save a lot of energy that would have been wasted otherwise and utilize such saved energy for other useful purposes.

Necessary rules, regulations in this respect may be formulated early in the greater interest of the country.

## 6. Research And Development

Programs for research on different type of energy in use in the country as well as on other prospective areas are to be undertaken. Areas to cover should include their availability, utilization, conservation, future development, environmental aspects and other related matters. Necessary facilities and resources are to be made available to implement such programs on a continuous basis. Collaboration among energy sector organisations and Research and Development (R&D) institutions, reputed universities are to be established to carry out such work. A part of the earnings of such organisations and government fund may be made available to finance such programs.

## 7. Petroleum Refining

Petroleum products are obtained through processing of crude oil at the refinery process units. Choice of crude oil and selection of various process units are based on the market demand, economic factors, etc. In Bangladesh, the only refinery (Eastern Refinery Ltd – ERL) was commissioned in 1968 with a rated capacity to treat 1.5 million tons of imported crude oil of Middle East origin to meet the local demand prevailing then and in the foreseeable future. Besides replacements, improvements of some of its vital equipment, and addition of few process units like LPG plant, vacuum unit, bitumen blowing unit, secondary conversion plant (visbreaker, mild hydrocracker unit), the refinery's overall treatment capacity still stands at the same 1.5 million tons per year though the market demand of various petroleum products has increased to 4 million tons during FY 2009-10. With shortage of natural gas and ongoing process of setting up power plants based on liquid fuels (diesel and fuel oil), the total country demand is estimated to reach 7.8 million tons in 2015, 10.5 million tons in 2020 and 18.5 million tons in 2030. On the basis of recent consumption figures, it is estimated that total country consumption during the FY 2010-2011 will be about 5.3 million tons.

Refined products are now imported to meet the deficit beyond those obtained from ERL refinery and some quantities obtained from local gas fields. But question remains whether it is better for national energy security, economic and other considerations to be so much dependent on import of products from other countries or to increase its local refining capacity and to what extent. In a free and competitive market, the market forces would have determined the factors to come to conclusions on such questions. In Bangladesh, the current situation is quite different. The lone refinery is 100% owned by Bangladesh Petroleum Corporation (BPC), a statutory body looking after the petroleum downstream sector on behalf of the government. The government / designated authority sets the price of the products at which they have to be sold, irrespective of the production cost / import price. Due to fixing lower selling prices for major products, BPC is incurring a huge financial loss, more than Tk 20,000 crores (2.8 billion USD) in accumulated loss. Though proposal for expansion / BMRE of ERL is discussed and agreed upon for several years, it is yet to take practical shape mainly because of lack of fund for investment.

Though the National Energy Policy 1996 has provision like “private sector will be free to set up new refineries”, no such thing has practically taken place in the country so far. Commercial considerations, especially the system of regulated product selling price is the main reason as nobody likes to enter into a business where there is no alternative but to incur loss.

Incentives for investment in setting up a refinery, like reduced tax for import of plant machineries, tax holiday/reduced tax during operation together with a guaranteed minimum price for the products based on international market price (Platts Singapore) parity, would help investors come forward in the refinery business. Private sector collaboration in expansion of existing ERL refinery or Private-Public sector joint venture for such a project or for setting up a new refinery would be a good step in this regard. No decision has been taken (no public announcement has been made) till now regarding the offers received from interested bidders against ERL advertisement made last year expressing interest for financing its BMRE Project.

The existing ERL plant has limitations in producing products of required quality, as is the trend / practice in the present day world. Gasoline (MS and HOBC) especially in respect of octane number, sulphur and aromatic content and diesel in respect of sulphur content, Cetane number are the major areas for which steps need to be taken. Implementation of BMRE project of ERL could take care of this subject besides increasing the local refining capacity, better energy security with more flexibility to meet product demand with lesser investment.

## 8. Crude Oil Transportation, Cost

Imported crude oil is currently brought in chartered ships from Saudi Arabia and United Arab Emirates in parcels of around 100,000 thousand tons. Due to draught limitations, such tankers are not able to come to Chittagong port but anchor near Kutubdia Island, about 75 km south of ERL. Lightering vessels owned by Bangladesh Shipping Corporation (BSC) each of capacity 12,500 MT then bring the crude oil to ERL jetty on the bank of Karnafuli River at Guptakhal, Chittagong. It takes about 11 days to release the mother tanker instead of normal 3 days, involving huge additional cost. The Chittagong Port Authority (CPA) does not allow night navigation for the oil tankers, even when empty; so the lighter vessels can bring only one parcel a day.

Construction of an oil jetty with connecting pipeline to ERL is an urgent matter to be resolved. The implementation of the project by BPC / ERL for the construction of a Single Mooring Point (SPM) near Kutubdia island with pipeline connected to ERL storage tanks, will take care of this matter.

## 9. Refined Products Import, Transportation Cost

About 65% of the demand of all petroleum products during the FY 2009-10 were met with imported refined products. Due to draught limitation at the Chittagong port, tankers with about 30,000 – 35,000 Million Tons take berth at Chittagong outer anchorage. In cases, depending on draught some lightering is necessary using coastal tankers (1,000 – 1,500 MT capacity) before the mother tanker comes to jetties of the oil marketing companies/ERL at the bank of Karnafuli River (like crude oil) to discharge the balance cargo.

With increased demand of products, especially for new power plants, and in absence of any jetty / pipeline from the sea, the situation would be difficult to be handled by Chittagong Port / BPC, besides involving huge additional cost. Expansion of local ERL capacity would reduce the volume of imported refined products and thus take care of this subject.

## 10. Product Pricing, Subsidy

BPC is now importing crude oil of Middle East origin (Saudi Arabia, UAE) through government to government (GtG) contracts bearing additional cost on transportation due to Chittagong Port limitations, etc. BPC is also importing the deficit products e.g. premium gasoline, kerosene, diesel, jet fuel and fuel oil, to meet the market demand. Whatever the import cost (with taxes and duties) or the local production cost (at ERL) may be, the end-selling prices of the main products are fixed by the authority / government. With big gap between the cost of production / import and selling price especially for kerosene and diesel, BPC's accumulated loss has crossed 200,000 million taka (around 2.8 billion USD).

It may be noted that at current international price of about US\$ 124/-per barrel for diesel / kerosene, the import parity price comes to about Tk 68.00 per litre while BPC is selling it at Tk 46.00 per litre (with revision in May,2011). With increasing price in the international market and increased demand due to recent setting of diesel oil / fuel oil based power plants, the loss figure is going to increase substantially if the current price setting policy goes on unchanged. It may be noted that diesel and kerosene alone constituted about 74% demand of all petroleum products in the country during the FY 2009-10 whose import, marketing & distribution is fully controlled by BPC along with jet fuel, gasoline, etc.

As kerosene is used for illumination purpose in rural areas having no electricity supply and for cooking purposes, the government is giving subsidy on kerosene price following Fiscal Policy of National Energy Policy. Regarding diesel, transport sector is its main user, about 54% during FY 2009-10. Agriculture sector was the second largest consumer of diesel (about 35%). The government is considering the socio-economic conditions of the mass people, the farmers, for keeping the price of these two items low (currently Tk 46/- per litre). Well-off people are also benefited by this low price e.g. diesel used in big cars, other means of transport, generation of captive powers in offices, apartment houses, large scale use of air-conditioners etc. where this subsidy is not required / desirable. If there are any subsidies to be granted then they should be aimed at end user level.

Fuel oil is going to have the largest growth rate with new power plants based on it. Unlike kerosene and diesel, import, storage and marketing of fuel oil is allowed under the private sector also. Somebody can take license for its import, for own consumption as well as for marketing provided he has required facilities, take license, meet the product specifications, etc. One power plant (Karnataka Power Corporation Limited (KPCL) at Khulna) is using this facility, but new power plants opted to rely on BPC's supply. Investment in infrastructure development, such as import reception facility, storage and distribution etc., are involved for doing it beside the big difference of import parity cost versus BPC selling price.

The government / authority raised fuel oil price to Tk 35/- per litre from Tk 26/- per litre in January 2011, to Tk 40/- per litre in April and Tk 42.00 per litre in May 2011, whereas the current import parity price is about Tk 56/- per litre, which means a loss of Tk 14/- per litre of fuel oil sold by BPC. With current rate of sale of 330,000 tons of diesel per month (with selling price of Tk 46/- per litre against import parity price of about Tk 68/- and 65,000 tons of fuel oil per month, estimated loss to BPC for only diesel and fuel oil is about Tk 960 crores (about 130 million USD) per month at current prevailing prices. The figure is expected to increase substantially in coming months and years as new power plants are commissioned.

Only in gasoline price (MS and HOBC), BPC usually gets some margin above import parity price, but the volumes sold are small, about 5.5% of total sales during FY 2009-10 (this share will go down with increase in volumes of diesel and Fuel Oil (FO)). Therefore, this does not offset substantially BPC's burden of loss.

BPC authority / government is following the correct system for price fixing of jet fuel on import parity basis, reviewing it monthly and doing adjustment when necessary. Ideally, this could be the case for other products also; with the government giving subsidy to the end users in sectors / areas if considered so necessary.

Though the National Energy Policy has a provision stating that the pricing formula for refinery products will be based on import parity prices with a negotiated discount, this is not practically followed.

We recommend changing the policy and the BERC price setting procedure.

BERC has a provision on Tariff stating that a licensee may submit to the commission proposal for revision of tariff along with detailed information. The commission, after hearing the intending parties may publish notification containing its decision within 90 days of receiving the proposal along with all information for tariff revision and instruct the licensee to publicize relevant information. This procedure of price setting in present day world oil market situation seems not suitable.

In most countries, where subsidies are given, it is only limited to target group use, such as agriculture, priority development projects and public transport. Subsidy in the wrong places only encourages increased demand and inefficient use, with serious economic damage.

Selective and sparse use of subsidies also prevent fraud, adulteration and other non legitimate action, while it benefits only these groups or economic activity that will directly need such a subsidy, such as agriculture or low income households.

# 11. Refinery Policy and Regulations Issues

The design capacity of country's lone Refinery, ERL is only 1.5 million tons per year against total sale of 4 million tons during the FY 2009-10. This figure is expected to be double by the year 2015 with commissioning of new power plants based on liquid fuels (diesel and fuel oil). Increasing the local refining capacity is an obvious option. But before comparisons and recommendations can be made on alternative refining configuration and trading strategy underlying sustainability of such a project, it is necessary to discuss the policy and regulations framework which will be of great importance for the project.

The key policy issues are:

- Future Pricing of petroleum products and gas; impact of subsidies/taxes and other deviations from free market pricing policy;
- The application of taxes and subsidies on refined products and gas;
- Private company initiatives to participate unhindered in all petroleum products supplies and including investments in refinery and marketing facilities;
- Mandatory min/max petroleum product specification limits for regional and environmental reasons meeting present situation;
- Future private imports of alternative petroleum products to balance product demand (including LPG, LNG)

## **The inland or domestic price for refined product should reflect the international market prices.**

Bangladesh uses a complex system of price setting mainly to establish the apparent need for subsidies.

Part of the methodology to be recommended is the assessment of market parity prices (as we recommend on basis of international acceptable price reports such as Platts and Argus) Throughout this study prices have been based on Platts Singapore Free on Board (FOB) for all products, with a motivation discussed in the assessment. Also this applies to other energy sources like natural gas, CNG and LPG. These also should reflect true market price levels and be competitive just because of their ability to contribute at the right price.

Most countries use a parity basis similar to their regional but reflecting international oil product market price levels, with the exception of a few (oil producing) countries that share their wealth with the domestic market, but still use Platts prices for their sales to foreign off takers.

## **Taxes are applied in almost all countries for a variety of reasons.**

Primary objective is to reduce excess and unnecessary demand by increasing the oil product price. This also has the beneficial effect that energy is forced to be used in an efficient manner. In general most countries use a levy and or duty on the refined product price, which is a direct source of revenue to the State Treasury. Alternatively, taxes can be raised on all imports of crude and products, but in a society where most products are inland produced, the most secure way is a tax imposed on products at the refinery gate, and where the oil refiner is made responsible for collection and transfer of the taxes to the Treasury.

Taxes will also provide State revenue, for example to finance major projects in the Petrochemical industry and other associated infrastructure. This is important to Bangladesh as the investment in a petroleum refinery is significant and bank loans may need accelerated refinancing if the sector credibility is unknown or weak. Beside a refiner's margin, which may be fluctuating, the security of revenue will be a major tool to secure financing for the project.

For Bangladesh with 6 million ton/year petroleum product consumption (as expected by the middle of the decade) even a small tax of Tk10 per litre (about 0.15 USD) levied on each product provides 1,000 million USD per year revenue to the Treasury, and a Tk10 taxation of only the transportation fuel provides 510 million USD/year.

Taka/liter	All products Million USD/year	Only transport fuel (=50,7%) Million USD/year
1	100,8	51,1
2	201,7	102,3
5	504,2	255,6
8	806,7	409,0
10	1008,4	511,3
15	1512,6	766,9
20	2016,8	1022,5
25	2521,0	1278,2
30	3025,2	1533,8
35	3529,4	1789,4

*Petroleum tax revenue per year*

The taxation as a source of revenue is therefore significant even if only transportation fuel use is considered (and agriculture, industry, power generation use is excluded).

**Subsidies are in most countries only limited to target groups use**, such as agriculture, priority development projects and public transport. The situation is different in the case in Bangladesh, where all products are receiving a subsidy<sup>2</sup> (often a price setting well below the market parity price). Such system is unheard of to our knowledge. Subsidy in the wrong places only encourages increased demand and inefficient use, creating serious deadlocks in cities, with serious economic damage.

It is better to allocate a lower tax rate to the carefully targeted dedicated user classes. For example the agricultural use of diesel in harvesting, irrigation, etc., machines is in many countries not taxed, or set at a low tariff. Usually a red dye is added to the oil product to identify the correct use and simplify the customs verification on the sector use of that oil product.

Selective and sparse use of subsidies also prevent fraud, adulteration and other non legitimate action, while it benefits only the groups or economic activity that will directly need such a subsidy, such as agriculture. It is not this study objective to recommend or make decisions on who needs to be subsidised, as long as it is used with care and within an overall policy structure.

**The Private sector has not been involved in the production and distribution of (main) oil products**, with the exception of small volumes of LPG, lubricants and bitumen, and some fuel oil. All responsibilities are assumed by the State and allocated to BPC for execution. Central coordination has advantages with regard to knowledge and national

<sup>2</sup> Except gasoline, as mentioned above.

security control, but the private sector is also a source of capital for investment in the refining and logistics as discussed in the Refinery part of this project. Also private involvement will increase efficiency and competition in a free market and therefore will be guarantee for the lowest price to the consumer.

Of course there are many varieties for involvement but in this context the private sector may well provide the capital and the investment required or use their international credit rating more successfully in the international banking community than governmental borrowing can achieve.

Also private companies have to be efficient in managing costs and revenues, usually better than state-owned type of oil companies where competition is not seen as a force to improve the operational efficiency. Aspects also cover the availability of knowledge to cope with technical and commercial matters underlying the oil industry. This covers entrepreneurial initiative, also a more general higher educational level within the company than within governmental departments.

Therefore the private sector will under the right conditions provide capital, competition, knowledge and flexibilities for the oil product supply. To our knowledge there are no countries where private sector involvement is as strictly prohibited as in Bangladesh, except for some of the old communist structured economies.

**Product specifications.** This will be discussed in detail in the separate report (Recommendations Report, Refining), but product quality will contribute to the wellbeing of consumers and will benefit ultimately in lower health costs.

**Importation of crude oil and oil products** should be without restriction. As discussed above, the private sector involvement will be beneficial to the consumer to secure the lowest price because of competition.

But if the local refining capacity is not increased substantially (as discussed in scenario's 1 and 2<sup>3</sup>) the volume of product import becomes so high that other alternatives may become interesting for the national energy supply. This will also require investment and manpower to realise these projects. LPG and even more LNG importation will be of importance to a energy poor country. The choice of scenario will therefore have an immediate consequence for alternative energy carriers; Nuclear, LNG, LPG, shale, wind, tidal, solar, and will in their turn require substantial amounts of money.

### **Summary on refinery policy and regulation:**

- Oil products and gas prices need to reflect true international market price levels to provide a sustainable demand and supply provision.
- Taxes are a deterrent for inefficiencies in energy use, and also income to the State for project financing.
- Subsidies need to be targeted to specific user categories and be identified critically.
- Private sector involvement in the oil supply will stimulate competition and lower prices, and will also be capable to provide capital for the oil industry infrastructure.
- Product qualities need to reflect regional standards and provide long term welfare.
- Imports activity of energy needs to be accessible for all interested parties to participate both for direct supply to consumers and for the development of the energy infrastructure.

### **Following policy action points are therefore proposed:**

- Set a minimum domestic price monthly at least equal to, or above the market parity price (based on Platts Singapore/ Arab gulf);

<sup>3</sup> See Refining Recommendations Report.

- Consider to impose taxes on transport/motor fuels;
- Allow private parties to initiate, or participate in energy projects;
- Grant subsidies only to end user groups in need, and clearly targeted;
- Product qualities to meet at least regional standard and reflecting international test methods.

## 12. Price Control Policy

Current Bangladesh policies for oil and gas products are based on government (BERC) enforced price controls. But these general price controls in this study are not (or only to limited extent) supported and the whole discussion in this study is focused on a change in that policy.

Price controls (below true international market prices) are causing inefficient use of scarce energy carriers (petroleum products and natural gas), create shortages and put pressure on supply lines. This all hurts producers/importers and consumers, as well as the economic growth of the country in the medium term.

What should determine the domestic inland Bangladesh petroleum product price for oil products – diesel, kerosene, etc. – is the quantity of these products that producers (refinery and importers, whether State and Private) are willing to supply at international market equilibrium prices, and that volume supplied at that price is or has to be accepted by local domestic consumers or otherwise it would be better to sell the product to the (better priced) international market buyers. So to that basic open market principle, either the domestic market accepts the international price or if not acceptable then there will be fewer products imported until local consumers will pay that price. Such a "market-clearing price" evolves in every competitive market.

What happens, then, when the government decrees that the price of petroleum products is to be below the international markets parity? The obvious answer is that consumers now can obtain these products for less. But that answer is incomplete.

At a too low price, consumers will want more than they wanted at the higher market parity price. At the same instant at that lower price, producers and importers want to supply less volume. The necessary result, therefore, is a shortage and/or a monetary loss: either the volume demanded exceeds the volume supplied, or the volume supplied at the lower price is made available but this will cause the supplier (BPC) to incur this 'subsidy', i.e. the difference between the lower domestic price level and the higher true market price, and, as a result, a severe loss.

An entirely free price derivation between market parties based on the economics of equilibrium is a long term goal, but not practical to implement in the short or medium term. On the other side the current product price setting is unsatisfactory for long term sustainability and does not promote demand efficiency.

Therefore an intermediate solution can be derived with elements of free market economy and governmental price control combined.

# 13. How Petroleum Product Prices Could Be Calculated In Bangladesh

Assume the retail price of petroleum products are regulated by government but is changed at the beginning of every month. The calculation of the new petroleum product price is done by BEREC on behalf of the BPC and other suppliers.

The pump price is composed of a number of price elements and these can be divided into international and domestic elements. The international element, or Basic Fuel price (BFP), is based on what it would cost a importer of Bangladesh to buy product from an international refinery and to transport the product onto Chittagong.

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## 13.1 Basic Fuel Price (BFP)

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The BFP formula reflects the realistic cost of importing a litre of product from international refineries with products of a similar quality compared to local ERL specifications on a sustainable basis.

The BFP formula changes on the first day of every month based on the average past months daily international price movements and exchange rate fluctuations based on the previous month international daily prices.

BFP is based on international market prices of petroleum products, reflecting the cost of what the actual import of product to Chittagong would be.

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## 13.2 Components include:

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### 13.2.1 International part

#### International petroleum market spot prices

The largest component of the basic fuels price is the price that one would be paying on international markets when physically importing product. The FOB (Free On [ship's] Board) product prices from different locations in the world such as the Arab Gulf (AG), based on international product availability and product quality, are used. For the FOB price of diesel, kerosene, jet, fuel oil etc., the BFP formula uses spot prices calculated as a percentage of the FOB Singapore price and the balance (100 minus Singapore percentage) of the Arab Gulf price depending on actual situation. The quoted spot price market premium, if applicable, is to be added.

### **Freight cost to bring product to Bangladesh ports**

The freight component of the BFP reflects the cost of carrying the products from AG and / or Singapore as appropriate to the desired port for delivery.

Freight cost is to be calculated on the basis of tariffs as published by the World Scale Association for transporting refined products via 25,000 ton to medium (80,000 ton) range vessels to a weighted average for Chittagong port, plus demurrage for an average 25,000 ton vessel for 3 days, adjusted with the Average Freight Rate Assessment (AFRA) of the London Tanker Brokers Panel (for explanations see refinery assessment Ch 2)

### **Insurance costs**

Calculated as 0.15% of the product's FOB and freight costs, to cover insurance cost, as well as other costs such as letters of credit, surveyors' and agents' fees, and laboratory costs.

### **Ocean loss allowance**

In international petroleum products trading, shipping and insurance, a loss of 0.3% for products has been accepted as a normal leakage and evaporation loss. Simply put, this means that the "normal" loss is not insurable and has to be accepted by the buyer. The buyer therefore has a financial loss of 0.3% of FOB, Insurance and Freight costs.

### **Cargo Dues**

The BFP calculates, as applicable, the Cargo Due charges in terms of petroleum products vessel harbour fees at Chittagong or other ports.

### **Coastal Storage**

This element allows recovering of the costs realistically incurred in a substantial import scenario, related to costs of the handling facilities at coastal terminals providing storage. In this study it was assumed at 1.50 USD/ton.

### **Stock Financing Cost**

The BFP includes a charge for the financing of a 30 day's storage tank (inside ERL and MI) stock of an importer such as BPC, at an interest rate of equal or 0.6 percentage points below or over LIBOR.

The BFP as determined above is then converted to Taka per litre by applying the applicable Taka/US Dollar exchange rate and appropriate conversion factors of weight units (ton, kilogramme) into volume units (cubic meter, litre).

## **13.2.2 Domestic Elements**

To arrive at the final pump or warehouse price (for heavy fuel oils) in the country, certain domestic elements like transport costs, government import tax, and / or proposed taxes (proposed in this study) and levies along with sufficient margins for retail and wholesalers need to be added to the international part.

### **Custom Duties and Taxes**

The custom duty, VAT and other tax elements imposed by the government on such imports as applicable from time to time.

### **Transport costs (Zone differential)**

Keeping in mind the import principle used, this element recovers the cost of transporting petroleum products from the nearest central terminal / harbour (Chittagong, possibly Mongla) to the inland depot serving the area or zone.

Transport costs to the different pricing zones are determined by using the most economical mode(s) of transport i.e. river barges, pipeline or rail. This is the only element whose values differ per pricing zone, and is the reason why total real costs should be divided among all tonnes transported to justify a 'post stamp' price for the whole country (so one single tariff for transportation, as is the case today).

### **Delivery costs (Service differential)**

This element compensates marketers for actual depot related costs (storage and handling) and distribution costs from the depot to the end user at service stations. The value is calculated on actual historical costs of the previous year, averaged over the country and industry. Again this should be on a post stamp approach basis.

### **Wholesale (Marketing) margin**

It is the money paid to the oil marketing company through whose branded pump or depot tank the product is sold, to compensate for marketing activities. This margin is currently controlled by the government, but should allow for sufficient compensation based on the oil companies' necessary return on their marketing assets.

The formula used to determine the wholesale margin could be based on the results of a cost/financial investigation by an energy audit carried out by a government appointed accountant firm into the profitability of the wholesale marketers. The level of the margin is calculated on an industry basis and is aimed at granting marketers a return of 15% on depreciated book values of assets, with allowance for additional depreciation, but before tax and payment of interest.

### **Retail margin**

The retail margin is fixed by BERC for a quarter or even one year if appropriate and is determined on the basis of actual costs incurred by the service station operator in distributing the product. Account is taken of all proportionate and directly retail related costs such as rental, interest, labour, overheads and profit. The way in which the margin is determined creates an incentive to dealers to strive towards greater efficiency, to beat the average and to realise a net profit proportionate to their efficiency.

### **Equalisation Fund levy**

The statutory fund levy is a fixed monetary levy, and the fund should be regulated by ministerial directives issued by the Ministry of Power, Energy and mineral resources. The Fund is principally utilised to smooth out fluctuations in the price of liquid fuels through specific targeted subsidy payments; or can be used to afford consumer groups like public transport and agriculture some tariff protection and to finance the crude oil purchases (working capital bridging short term loans).

### **Fuel tax**

Tax levied by Government annually to force efficient use of energy, control excessive demand.

**Customs & Excise levy, if any**

Local taxes, if any, levied by local authorities to fund road building and or other infrastructure. Any extra Central Government imposed customs duties can be added at the point of importation and port of entry for products and/or crude oil.

**13.3 Who sets and controls the petroleum product price?**

The petroleum product retail price is then still regulated by government (BERC), but changed every month on the first day of the month to reflect the volatility in international market prices (Singapore and / or AG). The calculation of the new price is done by BERC but in cooperation with and agreement by BPC and private parties supplying products to the country.

As the BFP is used by the government as the transfer price between refining and marketing in the price build-up for retail price control, the Refinery and consumers are price-takers.

Neither the local refineries nor the government has any control over changes in this international market price element, as it is based on truly international world and regional prices. It also means that Bangladesh refineries have to compete and prove their sustainability with very large and efficient international refineries, based in Singapore, China, the Subcontinent of India and the Arabian Gulf.

Wholesale and retail margin and transport element charges are based on actual cost incurred by the industry and are calculated according to specific formulae and evidence, ensuring efficiency in operations. These changes have to be approved by the Ministry of Power, Energy and mineral resources and by BERC before it is allowed into the price.

**13.4 What drives international petrol prices?**

Essentially, prices are driven by supply and demand for products in a particular market. Additionally crude oil prices have a major effect on the petroleum products' prices. A crude oil refinery's biggest input cost is purchased crude oil. In order for a refinery to make a profit, the price for the products manufactured from crude oil has to be higher than that of the crude oil price.

When crude oil prices increase – as they have quite sharply done over the past number of months – the petroleum product price must increase as is almost instantaneous in world markets so that crude oil refineries are able to cover their own costs and earn a margin to allow future expansion.

Bangladesh local refinery(ies) produce ideally in this study (scenario 3, 4 and 5) about 95% of the country's needed products from imported crude oil purchased at beyond anybodies price control by the middle of the decade, the rest 5% is produced from local natural gas condensate which is priced competitively. The country will continue to import crude oil and refine it into petroleum products but is less dependent on regional product price volatility and / or vulnerability in the actual vessel supplies.

The volatility in international oil prices has however to be reflected in the methodology of pricing policy to assess local domestic prices.

If there is no attention to this price volatility there will the risk of exposure to large unwanted losses because purchase cost of crude oil and products can result in large deviations between local and international prices even over short periods. Throughout the study there is emphasis on the need to realise a parity of domestic prices to the international market not only to reflect the true cost of energy but in particular to guarantee a local supply of products based on sustainable economics.



## 14. Products Under Private Sector

So far, the government has opened up the product market to private sectors in areas like lube oils, LPG, bitumen and fuel oil. Lube oils from local blending plants with imported base oil as well as finished lubricants are being marketed by many private sector companies competing with BPC controlled companies, without any price control for any of them. Four companies import LPG in bulk and market their product in their own brand and at their own price. This is unlike the free competitive situation like lube oil. Big gap in price of the two sources of LPG has some effect in sale of private sector LPG whose installed capacity is only partly utilized.

Bitumen is the other product fully open to private sector with no price restriction for import (in bulk with local packing or in drums). They compete with ERL produced bitumen.

Import of fuel oil by private sector is allowed, both for own consumption as well as for marketing purpose if one meets the fixed requirements like having facilities for import reception, storage, distribution, etc. and takes required license. Only one power plant, KPCL, is using imported fuel oil availing this provision; but so far, no other plant user has come up mainly because of currently available BPC supply and at a cheaper rate. This is another argument to abolish the strange price fixing as it distorts the right decision

The government has kept full control, till now, over the import, marketing and distribution of the main products like gasoline, kerosene, diesel and jet fuel. Central coordination has advantages with regard to knowledge and national security control, but the private sector is also a source of capital for development of infrastructure. Also private sector involvement will increase efficiency and competition in a free market and ensure a better price to the consumer. The private sector will under right conditions provide capital, competition, knowledge and flexibility for the oil products' supply.

## 15. Quality Control, Standards

Assurance of quality of fuel products as per approved specifications is very important for smooth running of the engines and proper burning of the fuels which gives desired output as well as help control environmental pollution. Vehicles are designed based on specific fuel requirements – for both gasoline as well as diesel. Engines based on fuel oil also have specific specifications. Each product meant for specific purpose, must be of approved composition, quality.

Bangladesh Standards and Testing Institute (BSTI) is the authority designated by the government for formulation of National Standards and responsible for the quality control of products. Specifications for petroleum products are set in consultation with relevant committee adopting international standards with adjustments as considered necessary. Internationally accepted American Society for Testing and Materials (ASTM), Universal Oil Products (UOP), Institute of Petroleum (IP) test methods are followed to check the quality of products in Bangladesh. However, the facilities, resources BSTI have are not capable to ensure the quality in the practical field. ERL has a full-fledged laboratory of its own to test petroleum products; the marketing companies also have facilities to test the basic items. But the regulatory authority lacks manpower, facilities to check and enforce compliance of the standards.

BERC is yet to have full set up and control over subjects like quality assurance.

The standards, specifications of oil products needs to be modified / improved by the relevant authority to meet changing demand of fuel, engines and environmental considerations and proper systems are to be there to ensure compliance of such standards, specifications.

Two products e.g., gasoline (regular and premium grades) and diesel are very important in respect of quality changes in the present day world including environmental considerations. Existing standards of these products are needed to be upgraded:

Addition of leaded chemicals for enhancing Octane number of gasoline is totally banned; there should be checks on use of other chemicals for this purpose, use of proper process units are preferable. If unavoidable, only chemicals approved and in use in countries like USA, UK, France with proven track record may be allowed for use in Bangladesh.

In view of increased use of imported fuel oil for new power plants, its sulphur content may be considered to be reduced from present specification limit of 3.5 % to 2 % in view of its environmental impact.

## 16. Adulteration

Adulteration of petroleum products by mixing a product with different products or additives, usually with something of lower grade or lower price, is to be checked and strict measures taken to prevent that. Regular field level checks by the designated authority, BSTI and punishment of the offenders, if detected, are necessary in this respect.

Pricing of products sometimes causes adulteration. For example, fixing lower price for kerosene than diesel (which was the case for about 8 months in FY2003-04) caused much adulteration of diesel with kerosene which subsequently stopped by equalizing price of both items.

Adulteration of gasoline (MS and HOBC) and diesel by mixing gas field condensates with them was detected in many cases earlier. Recently permission has been given for setting up small-scale condensate fractionation plants at different locations throughout the country. Products from such plants result in an imbalance in the quality and quantity of products' market in the country. It is essential to have some integrated approach between upstream and downstream petroleum sector and find out ways for the best possible utilization of the condensates without sacrificing the quality of products and the environmental aspects. Policy must be that all products must meet the set minimum specification.

With full opening of lube oil market, without any restriction, many unbranded products have flooded the market. It is said that about 50 brands of lubes are marketed now without any proper check on their quality. Though conscious persons pay higher prices for good branded lubes in sealed containers for use in their cars, engines, common people usually opt for the low priced products, from open drums without quality seal, which cannot serve the purpose for which the lubes are used. Study report published in local newspapers mention that about 50% of the lubes sold in the market are of low quality and low priced. Urgent measures to check quality of lubes and compliance of standards needs to be taken.

The following articles may be added in the National Energy policy to check lube oil quality:

- All blending plants should be of international standard and have required laboratory facilities;
- Marketing of straight mineral oil, mild additive-treated lubricating oil and any type of loose lubricating oil should be prohibited; marketing in small packs are to be encouraged;
- Quality standards of lube oils should be defined according to international standards and enforced through checks;
- The minimum standard of lubricating oil will be API-SC/cc for engine oils and for industrial grades as per manufacturer's recommendation;
- It will be preferable to have a licensing arrangement with internationally reputed oil company(s) or lubricant blending plants for product formulation;
- Unless the regulations are enacted for disposal of used lubricating oils, these will be exclusively used as fuel (with fuel oil) and no recycling will be allowed.

## 17. Storage Capacity

All imported crude oil received at ERL is stored at storage tanks located within ERL site, total capacity being about 200,000 MT, which is around 45 days requirement. ERL has a good capacity to store its refined as well as intermediate products. The three oil-marketing companies under BPC e.g. .Padma Oil Company (POCL), Meghna Petroleum Ltd (MPL) and Jamuna Oil Company Ltd (JOCL) have their main installations at Guptakhal area, Chittagong, close to ERL. They have their own storages for the products, receiving those from ERL as well those imported by BPC. A portion of these products are sold locally, most of these are dispatched to their depots located throughout the country.

The storage capacity of all products located throughout the country, excluding crude oil, is about 690,000 tons out of which ERL and the main installations (MI) of the 3 marketing companies, all located at Chittagong, accounts for about 500,000 tons This means about 72% of the total product storage capacity of the country is located at Chittagong leaving rest 28% spread all over the country. Out of these 28%, consumption of each product is different, also differs at different locations besides seasonal variations in demand of some products. Also all products are not sold at all locations.

There does not appear to be specific recommendations to be made in terms of mandatory storage capacity, in respect of **operating storage**. M&D operators are well aware of the constraints that shape their activity, in particular in respect of the weaknesses of the products transportation system and the seasonal variation of the demand. However, a minimum operating storage capacity should be set. This capacity should be at least 14 days of average sales, with adjustments for those depots that may be particularly sensitive to irregular supply from MI or intermediate hub. All power plants as well as large users running on liquid fuels that are directly supplied from the MI should also ensure their fuel supply system, in particular storage, meets the general target.

The most important issue M&D operators are facing is to receive a margin that allows them to implement the infrastructure required by storage needs and to get sufficient funding and financial autonomy to undertake that necessary investment.

However, one of the current key issues is that many storage sites have no tanks to store such main products as automotive fuels (regular and premium gasoline) and fuel oil. Policy should address the need for some key regional storage to dispose of storage capacity for such products, in order to meet the local demand and to curb additional transportation cost incurred where products have to be transported by road from far away storage sites over long distances.

The provision included in the NEP 1996 already states that **strategic stocks** should shift from 40 to 60 days of consumption. Such reserves in storage tanks are to be distributed all over the country and reserve capacity for each location is to be determined by considering extreme natural events like cyclone, drought and flood". Situation of a "war" should be included to cover volatile areas which are beyond our control.

This is far from being met, as the only such strategic storage, Emergency Preparedness Offshore Liaison (EPOL), does not offer more than 3,000 tons, and is moreover, de facto allocated to the Military. Indeed, what appears more important is first to enforce the existing regulation rather than to make it more constraining. In a country like Bangladesh that is heavily submitted to harsh climatic phenomena, such as cyclones, droughts, and to uneasy transportation conditions, strategic storage has to be considered seriously.

In order to make policy more efficient, particular attention should be paid to such key aspects as:

- Definition of the notion of 'strategic stocks', e.g. should it include all or part of the storage capacity of the operating storage operated by the M&D companies, or consist of dedicated, not open reserves?
- Which types of products should be included, and in which proportion? Should it only consist of refined products, or could it also include crude stocks?
- Define the reference of the 'day of consumption', e.g. is it an average day (the yearly demand divided by 365) or a peak day to be defined (e.g. the demand recorded in the peak month divided by 30)? Define the reference years to be used to define the day of consumption;
- Specify the minimum geographic locations where the storage stocks should be installed;
- Specify the operator(s) in charge of building, operating and maintaining the stocks, its mandate, reporting and modus operandi, as well as the financing scheme.

# 18. Products Transportation

Most of the petroleum products consumed in the country are dispatched by the 3 marketing companies from their MIs at Chittagong to their depots at various locations of the country either by water ways or by Railways. Currently, share of railway for such transfer is about 14%, the rest portion being done through the other mode.

## 18.1 Bangladesh Railways

Bangladesh railways send out petroleum products to different rail head depots like Sylhet, Srimongal, Monglabazar, Chandpur, EPOL Dhaka in the eastern zone and Rangpur, Parbatipur (partly) in the western zone, from Chittagong MIs while depots at Rajsahi, Natore, Harian, Parbatipur (major part) is supplied through broad gauge system in the western zone from Daulatpur. Besides, there are power plants in operation and new more are coming soon, to be supplied with petroleum products through the Railway. But there is already shortage of engines, tank wagons and even manpower (drivers) to meet the existing demand during irrigation season. As a matter of policy, improvement of the railway system should be given special priority considering the additional load of new power plants.

Due to technical reasons, reported cracks on Jamuna Bangabhondu Bridge, long distance travel and shortage of engines, tank wagons etc. difficulties are faced to supply oil to Rangpur. Making the existing Parbatipur--Rangpur meter gauge section, about 45 km length, to dual gauge system would facilitate alternative and better supply route from Daulatpur using Broad gauge system.

The Dhaka-Chittagong railway line is partly double track in 3 sections. Making the entire length double track would help Bangladesh railway ensure required fuel supply quickly and in a better way besides serving other sectors, saving lot of fuel and travel time at the national interest and better earnings for its own benefit.

## 18.2 Waterways

Out of the 86% petroleum products are sent out from Chittagong MIs of the three M&D companies, the largest share goes through coastal tankers, capacity 1,000 to 1,500 metric tons each, having design ability to cross the Bay of Bengal. Most of the fleet are old and face draft limitations, require minimum 12 feet, to travel upstream.

Shallow draft tankers, the smaller version oil tankers, require about 6 feet draft for carrying a load of about 500. ton. They are used to carry products upstream, like Baghabari depot from Godnail, Fatullah depot. Recently a few of them, with modern design, have got Bay crossing permission and so can carry products directly from Chittagong to Baghabari.

For a country like Bangladesh with so many rivers/ waterways, modern tankers with improved design, flat bottom, able to carry bigger loads with same draught limitations, would be beneficial to all concerned. They can also reduce their fuel consumption and the handling loss. Currently the carrying cost for coastal tankers is Tk 2.97 per ton-nautical mile, while it is Tk 4.02 for the same unit for smaller shallow draft tankers.

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### **18.3 River Dredging**

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Siltation of rivers is a regular phenomenon hampering the riverine transportation especially during dry winter season. The Bangladesh Inland Water Transport Authority (BIWTA) is entrusted by the government with the responsibility of keeping the river routes navigable by dredging of required areas. But their resources are considered limited, needs to be improved. There are reports of vessels stuck up in the routes in some areas during dry winter season; besides proper dredging will result in more available draught for the tankers; enabling them to carry bigger loads, have better economy.

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### **18.4 Pipeline**

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In a modern day world, transportation of oil products through pipe lines is a very common and easy, economic system. In Bangladesh situation, oil transportation specially diesel and kerosene from Chittagong to Dhaka area seem to be the first option to get benefit of such a pipe line. It may be mentioned that 911,500 tons of diesel and 120,000 tons of kerosene was sent out from Chittagong to Godnail and Fatullah depot during the FY 2009-10; the quantity is increasing much with addition of new power plants. A single pipeline can carry such products, more than one, very fast and economically.

Installation of a small pipe length for reception of jet fuel from rail wagons at Airport station area to Dhaka airport depot (KAD) storage tanks seems to be an unavoidable option.

## 19. Marketing & Distribution, Role Of Private Sector

Currently BPC is handling about 92% of the petroleum products of the country (FY 2009-10 situation), having authority to import and market major products like gasoline (MS and HOBG), kerosene, jet fuel, diesel and most of the fuel oil. The three marketing companies under BPC do the marketing of the BPC products throughout the country using their network of Dealers, Agents, Packed point dealers (PPD) and LPG dealers..

The private sector is currently involved in import, blending / bottling and marketing of products like lube oil, LPG, bitumen and have their own storage, plants and marketing network. Only KPCL, a private sector power plant is using fuel oil imported under the private sector

Though the National Energy Policy, 1996, has provision like “the private sector will be encouraged to invest in infrastructure like pipeline(s), including common carriers, storage and distribution / handling facilities”, participation of the private sector is still limited. A very good opening has come up with setting up of new power plants based on fuel oil where private sector could be very much involved in import and distribution of the required fuel oil. But practically it is not happening. Adverse price difference (lower price of fuel oil fixed by the government / authority for the product sold by BPC through its subsidiaries than the import parity price) seems to be the main reason for such a situation besides absence of required infrastructure. Fixing selling price on import parity basis and giving subsidy, if the government so desires, to very defined and targeted end users, would attract the private sector in fuel oil business including import, development of infrastructure etc and thus reducing huge load on BPC. This will involve competition and better efficiency of energy use.

The three marketing companies under BPC are ultimately selling the products through the Agents, Dealers, Packed Point Dealers (PPD) and LPG dealers who are private operators. Currently, there are 1,455 Filling Stations, 2,923 Agents/ Distributors, 546 PPD and 2,269 LPG Dealers throughout the country under the three Marketing companies of BPC. Their commission, transport cost, etc. are currently fixed by the government / authority covering each product at every location of the country. The provision of the National Energy Policy “the commission of the marketing companies and dealers will be left out to be determined by the marketing company or by the individual retailer“ is not practically followed.

On the transportation sector, Bangladesh Railways (involving 14%) is government controlled; most of the riverine vessels (coastal tankers and shallow draft tankers) and road lorries are owned and operated by the private sector. Natural calamities, human related factors sometimes led to situations in the past when the whole country was stuck up. Some alternative system like proposed pipeline to Dhaka area and transportation of jet fuel to Dhaka by railway, as discussed in earlier sections, need to be considered as a matter of policy.

The commission of the marketing companies under BPC is paid as per rate fixed by the Government / authority. It is observed that these companies are now making profit and surviving basically on the profit made from a small area namely lube oil, competing with private operators; their income from main products are not sufficient for their good functioning. As a major consequence, these companies are not financially capable of initiating and implementing investment policy of their own. For developing and improving infrastructure to meet growing requirements, they are dependent on government fund involving lengthy and complex procedures.

## 20. Health, Safety and Environment

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### 20.1 Legal standards regarding emissions from the refinery are set by the

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Environment Conservation Act (1995), Act 1 of 1995 issued by the Ministry of Environment & Forest.

The law comprises general requirements. Detailed limitations for emissions to air and water are set by the Notification, dated 12 Bhadra 1404 / 27 August 1997.

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### 20.2 Permits for installations

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For the purpose of granting Environmental clearance certificate (permit), industrial units and projects have been divided into four categories depending upon the generic environmental impact:

- Green
- Orange A
- Orange B
- Red

Oil refineries are listed as “red” installations with the most stringent requirements regarding the permitting process. This is in line with international best practice.

Although the list mentions many facilities of very limited environmental relevance such as restaurants, hotels and book binding, it does not mention tank farms or petrol stations. Considering the fact that the latter installations are significantly more environmentally relevant it is recommended to extend the list accordingly - not necessarily as “red” installations but as installations that require environmental clearance.

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### 20.3 Requirements

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Rule 13 of the above mentioned Notification, dated 12 Bhadra 1404 / 27 August 1997, determines that:

*“in order to fulfill the provisions of Clause 20 (2), para (e) of the Act, the limits of waste liquid discharge and gaseous effluent shall be determined by those given in schedule 9,10,11 and the same for classified industries by those in schedule 12”.*

### 20.3.1 Refinery

The following schedule gives concrete requirements for refineries:

#### Oil Refinery

##### Effluent

Parameter	Source	Maximum Limit	Unit
Sulphur Dioxide	Distillate	0.25	kg/ton
	Catalytic Cracker	2.5	kg/ton
Total Suspended Solids (TSS)		100	mg/l
Oil & Grease		10	mg/l
BOD <sub>5</sub> 20°C		30	mg/l
Phenol		1	1
Sulfide (S)		1	1
Waste-water		700	m <sup>3</sup> /1000 ton of unrefined oil processed

SO<sub>2</sub> from distillation and catalytic crackers is the only requirement regarding air emissions. As far as SO<sub>2</sub> is concerned there are more relevant sources and the issue is not covered sufficiently by restricting requirements to only two sources. It is recommendable to define a “bubble” limitation for the whole refinery, which gives the operator enough freedom to find the most cost effective mitigation measures. Additional requirements regarding Volatile Organic Compound (VOC) and NO<sub>x</sub> are also recommended..

The remaining requirements cover emissions to water. The given limitations can only be achieved by applying a fully-fledged wastewater treatment including biological treatment. It is questionable if this was the actual destination of this requirement.

The ERL refinery does not comply with any of these limitations. This also raises questions regarding enforcement, execution and compliance.

The existing requirements do not cover the handling of waste at all.

### 20.3.2 Marketing installations

Currently, there are no requirements regarding marketing installations such as tank farms, petrol stations, etc. although these installations can cause relevant environmental impacts. These are to be covered under the regulations.

### 20.3.3 Safety

Major accidents in chemical and hydrocarbon processing industries have occurred worldwide. In Europe, the Seveso accident in 1976 prompted the adoption of legislation aimed at the prevention and control of such accidents. In 1982, the first *EU Directive 82/501/EEC* – so-called Seveso Directive – was adopted. The current Seveso II Directive applies to some thousands of industrial establishments where dangerous substances are present in quantities exceeding the thresholds in the directive. Similar laws are in place in the USA and many other countries worldwide.

Refineries are always subject to this legislation - tank farms generally do not exceed the given thresholds.

All installations that are subject to this safety legislation do have to draw up a safety report consisting of:

- description of the installation (process description, flow sheets, plot plans, etc.);
- description of the dangerous substances that are handled within the installation;
- description of safety measures and installations;
- systematic process hazard analysis (e.g. Hazard Operational Analysis (HAZOP));
- consequence calculation for possible major accidents.

Safety reports have to be updated every five years and are part of the permitting process.

Although the existing explosion protection legislation covers a minor part of these issues, there is no comprehensive approach which needs to be taken care of.

Deficiencies regarding enforcement, execution and compliance are obvious - at least at the marketing installations, which do not seem to have safety management systems according to international best practice.

### 20.3.4 Products-related environmental protection

The overall environmental impact of refinery and marketing installations is significantly lower than of the use of liquid hydrocarbons as fuels. The emission of fuel especially in automotive use takes places throughout densely populated areas and at low emission heights, i.e. the emissions of the use of refinery products are not readily subject to dispersion but become health-relevant immediately.

Thus, environmental protection related to liquid hydrocarbon fuels is an issue that has to concentrate on the use of the products rather than on production and marketing.

Diesel is the most relevant liquid hydrocarbon automotive fuel in Bangladesh and its most relevant environmental impacts are sulphur dioxide and particle emissions.

Particle emissions depend mainly on motor technology and only to some extent on product quality, whereas sulphur dioxide (SO<sub>2</sub>) depends on product quality only and cannot be influenced by motor technology at all.

Bangladesh currently does not have a liquid hydrocarbon policy. Internationally, plans are in place for the improvement of fuels over a period of time that enables manufacturers of automobiles, importers and all other stakeholders to prepare for change. Such plans have to be based on legislation. The Bangladesh Environment Legislation Act comprises some vehicle related requirements but no product related requirements for liquid hydrocarbon fuels at all.

#### Sulphur in diesel

The current level of sulphur content in diesel is 2500 ppm and the government does not have any immediate plan to reduce diesel sulphur because of the price differential between 2500 ppm and lower sulphur diesel. Sulphur requirements worldwide differ widely - with mainly five different standards:

- 10/15 ppm (ultra-low sulphur): European Union, United States, Canada, Australia
- 50 ppm former EU standard
- 350 ppm: China, India, Thailand
- 500 ppm: Russia, parts of South America
- 2000 ppm: Brasil and other South American countries
- 2000 ppm or no regulation

It is recommended to set up a plan to decrease the maximum allowable sulphur content in Bangladesh to 350 ppm according to majority of the market in southeast Asia; the technical

recommendations regarding upgrading the existing refinery capacities are also based on this figure.

### Cetane number

Apart from sulphur, other diesel emissions such as hydrocarbons and particles can be influenced by product parameters such as the cetane number. Cetane number (CN) is a measurement of the combustion quality of diesel fuel during compression ignition. It is a significant expression of diesel fuel quality among a number of other measurements that determine overall diesel fuel quality. Cetane number is actually a measure of a fuel's ignition delay; the time period between the start of injection and the first identifiable pressure increases during combustion of the fuel. In a particular diesel engine, higher cetane fuels will have shorter ignition delay periods than lower cetane fuels. Cetane numbers are only used for the relatively light distillate diesel oils.

Generally, diesel engines run well with a CN from 40 to 55. Fuels with higher cetane number which have shorter ignition delays provide more time for the fuel combustion process to be completed. Hence, higher speed diesels operate more effectively with higher cetane number fuels. There is no performance or emission advantage when the CN is raised past approximately 55; after this point, the fuel's performance hits a plateau. In Europe, diesel cetane numbers were set at a minimum of 38 in 1994 and 40 in 2000. The current standard for diesel sold in European Union is set in EN 590, with a minimum cetane number of 51. Premium diesel fuel can have a cetane number as high as 60.

The effects of cetane number on performance and emissions of older technology diesel engines are reasonably well understood. Older technology engines, in this case those which employ indirect injection or lower injection pressures, rely to a larger extent on the fuel/air mixing in cylinder prior to combustion (premixed combustion). In this situation, the cetane number of the fuel, which affects the ignition delay, has a large effect on the initial combustion. A higher cetane number fuel will have a higher initial pressure rate rise in the cylinder than a lower cetane number fuel. Higher cetane number fuels will generally give rise to lower NO<sub>x</sub> and noise than lower cetane number fuels. Fuel consumption is likely to be higher as a result of the lower heating values of higher cetane number fuels. Lower HC and CO emissions have been reported with higher cetane number fuels, whilst the effects on particles appear to be engine specific.

In Bangladesh, the existing CN standard is 45; it is recommended to increase it to 51.

### Diesel adulteration

Kerosene is a common adulterant utilized for mixing with diesel up to 50 % in many countries. Adulteration with kerosene is not an environmental problem. The percent opacity value decreases significantly even at small level of adulteration. But the use of heavy fuel or even waste lube oil as a diesel adulterant is technically feasible and could cause severe environmental damage by increasing the total quantity as well as in toxicity of the emissions from vehicles. There is no policy in place to mitigate such adulteration

### 20.3.5 Standards

The standards, specifications of petroleum products need to be modified to meet the changing demand of fuel, engines and the environment. Proposed target specification limits for Motor gasoline (both regular and premium grades) are mentioned hereunder:

#### For Unleaded Gasoline (MS & HOBC)

Property	Proposed Limit
Sulphur, ppm max.	150
Benzene, vol % max	1.0

Olefins, vol % max	18
Aromatics, vol % max	42
RVP, KPA max	60 (8.6 psi)

**For Diesel**

Property		Proposed Limit			
			Poly Aromatics,	% max	11
			Flash Point,	°C min	35
Sulphur,	ppm max.	350	Distillation,	vol. %	95% at 360°C
Cetane Number,	min	51			