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

Petroleum Refining & Marketing (Package # 06)

➥ Marketing recommendation report

SOFRECO

in association with

srgb

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Abbreviations

BERC	Bangladesh Energy Regulatory Commission
BFP	Basic Fuel Price
BIWTA	Bangladesh Inland Water Transport Authority
BPC	Bangladesh Petroleum Corporation
BR	Bangladesh Railways
EPOL	Emergency Petroleum Oil Depot
ERL	Eastern Refinery Limited
FO	Fuel oil
FOB	Free on Board
FY	Financial Year
HOBC	High Octane Blending Component (Premium gasoline)
JOCL	Jamuna Oil Company Ltd
KAD	Kurmitola Airport Depot (Dhaka)
KPCL	Khulna Power Company Limited
LPG	Liquefied Petroleum Gas
M&D	Marketing and Distribution
MI	Main Installation (of Marketing companies at Chittagong)
MPL	Meghna Petroleum Ltd
MS	Motor Spirit (Regular Gasoline)
PDB	Power Development Board
POCL	Padma Oil Company Ltd
PPD	Packed Point Dealer
SDT	Shallow Draft Tanker

Marketing Executive Summary

When it comes to strategic products, the key challenge for the operators – and all stakeholders, including the State as main shareholder, policy maker and, still to a large extent, industry regulator – is to ensure that the right products are delivered at the right place in the right time. Then security of supply remains, by far, the #1 issue to be addressed. It implies that several actions be undertaken in different fields:

Infrastructure, to increase the storage capacity of some depots and to consider building new sites in areas where storage capacity is absent; to improve transport capacity between depots; and possibly to develop a second port of entry in Bangladesh;

Pricing, so as to give operators the means to develop their activities in a sustainable way, including in abandoning tapping public money to finance both investment and operation;

A specific consideration for **LPG**, which deserves to be regarded as the logical substitute for declining natural gas in the households market.

Infrastructure

Storage

Lack of storage capacity is a very pregnant issue in Bangladesh. Two products are currently at stake: diesel oil and jet fuel, and a third one (fuel oil) needs to be very rapidly developed to meet growing demand of oil-based power generation plants.

We recommend that the M&D companies implement as quickly as possible a **short term Plan of Action** that would, subject to further in-depth review, include:

- The M&D companies need to **build or convert about 40,000 tons of storage capacity**, mainly for diesel and jet fuel, in the Greater Dhaka and Southwest areas;
- In the Northeast and East Central areas, excess kerosene storage capacity could be allocated to diesel to offset the current, limited diesel storage deficit;
- In the Greater Dhaka area, deficit dominates for most products. There is an urgent need to first add diesel and jet fuel storage capacity, to be followed by kerosene. The situation of motor fuels should be monitored carefully, should the restrictive policy that currently prevails for CNG be pursued. The same goes for fuel oil, whose demand is growing due to increasing gap between supply and demand of natural gas;
- In the Southwest area, the situation is generally tight for diesel, and worsens in the dry season. Additional storage capacity is urgently required;
- The Western area suffers from a structural storage deficit, as oil products are supplied through railhead depots with no storage capacity, except limited volume in Natore. This is a matter of policy that requires further focus and discussion within M&D companies. The issue will be addressed in the following section (medium term actions). There is no short term action to be undertaken;

- The other areas are on the safe side. The MIs display a very healthy situation (+110,000 tons with satisfactory balance between products), and the same goes for the West Central area. In particular, the well-distributed excess capacity at Baghabari does not, under regular supply conditions, call for the construction of additional capacity.

A **medium-term Action Plan** should follow in the second half of the decade. It is obviously much more ambitious than the short term Plan. The M&D companies will need to convert or build 135,000 tons of new capacity in about 9 years, i.e. **95,000 tons on top of the short term Plan** requirements (there again, subject to further in-depth review). All areas need to some extent to be re-enforced, and all fuels are concerned, except fuel oil (for the general users, but not covering power generation).

Depending on their size and surplus / deficit status, the infrastructure to be added in the storage areas vary significantly:

- Four small- and mid-size storage areas (Northeast, East Central, South and Northwest), and the Southeast (the large MI at Chittagong). All areas already face, or will face storage shortage over this decade, in particular for diesel. They also enjoy significant kerosene surplus capacity, a situation that is expected to remain unchanged until at least 2020;
- The Southwest area will need close to 30,000 tons additional diesel capacity by 2020. Most of it will have to consist of new storage tanks, as surplus kerosene capacity will be much smaller than diesel requirements;
- In three areas capacity is already missing or non-existent. Greater Dhaka is already short in diesel and jet fuel. In 2020 storage capacity will be missing for all products (except FO for general users) and the shortfall is expected to reach 50,000 tons, not including jet fuel at the KAD airport depot. While there is still land available at Godnail, in particular at Padma depot, Fatullah is close to saturation. The question of developing a new site is raised and will need to be answered to before the end of the decade. A similar issue needs to be addressed in respect of the West area (Rajshahi - Harian).

Specific storage requirements for power generation. We have determined the storage capacity required at the site of the 38 oil-run power stations that are deemed to be running by the end of 2011, considering that their capacity will follow the electricity demand. The additional storage capacity to be built within the current decade amounts to 61,200 tons, including 34,000 tons of diesel and 27,200 tons of fuel oil.

Water and Rail transportation

The major difference between storage and transportation issues is that the latter situation is out of the control of the M&D companies, and indeed of the whole petroleum industry. Both the BIWTA and the Bangladesh Railways are entrusted by the government with the responsibility of keeping the river routes navigable and the railways system able to move cargoes across the country. Therefore, any improvement in the efficiency of transportation requires that the M&D companies work in close cooperation with the main two state-owned agencies.

Water transportation

We recommend that BPC meet with BIWTA to establish a joint plan of action, taking into account the interest of the M&D companies and the benefits for the country:

- Identify those key sections of rivers where navigability need to be enhanced in a first priority, for instance to improve access to Daulatpur and Baghabari;
- Estimate the resources required and the cost of mobilising them;
- Highlight the benefit to the country through a cost-benefit analysis. Focus should be applied to the shortest sections that deliver the best overall improvement;
- Establish a timed plan of action with specific targets and resources to meet them.

Also, the rapid expansion of the demand of diesel and fuel oil has started to considerably increase the transportation needs and the reliability of the vessels. The best option to enhance both capacity and reliability is to develop modern **tankers with improved design**, able to carry bigger loads with same draught limitation. Industry experts think that newly designed coastal tankers could be able to transport well over 2,000 tons per parcel while meeting current draught requirements.

Naval architects are ready to work on such new design and produce the blue print of new generation coastal tankers. However, they want to receive expression of interest from concerned parties (BPC, Tanker Owners' Association) before they start working on such a large project. We recommend that BPC meet with the Tanker Owners' Association to address this issue and meet with naval architects / shipyards to launch the study of a new generation tanker.

Railways

In respect of **infrastructure**:

- The main task for BR is to complete the implementation of double track over the (meter gauge) Chittagong-Tongi route;
- Develop dual tracks (broad and meter-gauge), e.g. to improve oil supply to the Rangpur depot through a dual gauge track on the 40-km long, meter gauge Parbotipur-Rangpur section, which would enable the Rangpur depot to receive direct broad gauge trains from Daulatpur;
- Purchase the required rolling stock (both engines and rail tankers) and hire engine drivers whose number is far below the minimum level required to operate the engines.

Need for Enhanced Cooperation

There is a general lack of cooperation between BPC and the M&D companies on one hand, and BIWTA and Bangladesh Railways on the other hand, with regards to both equipment (e.g. dredges, rolling stock requirements) and day-to-day operation. Tighter cooperation is required at all levels. It needs to be established where it is missing, and deepened where it already exists but is not satisfactorily exercised. Mutually agreed procedures should be developed in the fields of:

Long term planning : BPC and M&D companies should devise a long term **Petroleum Products Marketing & Distribution Master Plan**, involving transportation operators in order to identify and determine the needs of Bangladesh in terms of volumes of products to be transported; transport routes; storage requirements; frequency of trains and coastal tankers; schedules; duration of journeys. Energy audits presented in the Policy Recommendations report are fully part of the Master Plan.

Once under implementation, the Master Plan should be maintained and adjusted, if need be, to take into account the evolution of the demand (e.g. in terms of volumes and location) and the possible technological improvements of the transportation system. Periodical meetings (e.g. every two years) should take place with all parties involved to proceed with such evolution.

Medium term operation: Transport needs are currently presented and discussed during large size meetings that take place every year in November (before start of the irrigation season), presided by Secretary, Energy Division, and attended by all concerned including representatives of other concerned ministries (including Railway). In the mean time there is little flexibility to modify the decisions taken. We propose that transport requirements be discussed and determined on a regular, more frequent basis and at a lower level to allow for added reactivity in case of changes in the demand or supply patterns.

Short term operation: Information concerning the availability of wagons and engines and the consequences on the size and schedule of rack trains should be transmitted by BR yardmasters to M&D dispatch facilities in real time, in order to enable M&D companies to handle storage facilities as efficiently as possible.

Oil Products' Pipeline

Bangladesh is expected to face a dramatic development of the oil demand, in particular for diesel and fuel oil. Demand should be multiplied by 2.5 in 2020 (from 2010 consumption) and 4.5 in 2030. A products' pipeline would offer a much suitable alternative to coastal tankers and rail tankers on the trunk route from MIs to the Dhaka and West Central areas.

The pipeline we recommend BPC to undertake originates at the site of the future refinery on the mainland, near the Kutubdia Island, and ends at the Baghabari depot; It is routed through the ERL refinery in order to either unload products at ERL coming from the future refinery, or load products produced at ERL or stored at the MIs, depending on the scenario that will eventually be selected by Bangladesh authorities.

The main offtake is at Godnail depot; however, we recommend that a new, larger storage site be constructed around Dhaka (see Section 4.5 below) to complement storage capacity at Godnail and Fatullah. The final offtake is at Baghabari in the West Central area.

The pipeline is designed to meet demand requirements in Central and Western Bangladesh at least up to 2030 for the main five oil products (MS, HOBC, diesel oil, jet fuel and kerosene). It is designed to transport 6.5 million tons from the future refinery to Godnail (312 km long, 18-inch dia), and 2 million tons from Godnail to Baghabari (136 km long, 12-inch dia). The total capex of the first leg, including 10% contingencies, is estimated at 292 millions USD. The cost of the second leg is estimated at 89 million USD.

The cost of transportation is 11.8 USD/ton and 11.2 USD/ton for each of the two legs, respectively. This cost may seem high, when compared with the usual pipeline costs observed throughout the world, due to a longer than usual lead time (three years) for construction; an above-average number of special points (rivers, marshes, etc.) along the pipeline route; and the fact that the pipeline will not be used at full capacity from start-up, as the build-up period (the time period required before the pipeline is used at full capacity) follows the demand increase and lasts over several years.

Also, prices are based on international, well-admitted standard costs for steel, equipment and civil works. Use of lower-cost contractors (some local) and steel from alternative sources (other than Japan), may reduce substantially the cost of construction.

Pricing

Towards economic pricing

All price components (refinery / import price, transfer / wholesale prices and end user / retail prices) are currently established and fixed by the government. All domestic elements are included in a price structure or price list that is amended whenever the government considers they have to do so. Indeed, prices have since evolved following mainly political and social objectives rather than economic considerations; they do not carry any more relationship to the real variations of the costs components.

We recommend that the concept and levels of oil prices be completely overhauled in order to set a clear and sustainable link to the real economic patterns of the industry. The determination of the technical costs (transport, wholesale, retail) should be based on the results of an independent cost/financial investigation, and operators' margins would be then established along a few main principles:

Wholesale margin (M&D companies). The level of the margin should be calculated on an industry basis and aimed at granting marketers an acceptable return. It is definitely necessary that the cost base used to set the margin does include assets depreciation, in order for the operators to generate the money required to invest and develop their activities. The industry should be

allowed by the government to operate autonomously and shift from the current government fund allocation system.

Retail margin and transport cost. They should be determined on the basis of actual costs incurred by the dealer or agent or by the transport operators. In determining the real costs, account is taken of all proportionate and directly related retail or transport costs such as investment, interest, labour, overheads, working capital and profit. The way in which the margin is determined creates an incentive to dealers and transport operators to strive towards greater efficiency, to beat the average and to realise a net profit proportionate to their efficiency.

Removing subsidies

All petroleum products (generally excluding gasoline), as well as natural gas, are receiving a subsidy through a price setting well below the market parity price. The problem is that subsidy in the wrong places only encourages increased demand and inefficient use, creating serious deadlocks in cities, with serious economic damage. We consider it better to allocate a lower tax rate to carefully targeted dedicated user classes, such as the agricultural use of diesel in harvesting, irrigation, etc.

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. 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.

However, 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 we recommend that an intermediate solution be devised with elements of free market economy and governmental price control combined.

Economic regulation

Most downstream activities are indeed natural monopolies: bulk marketing and storage is conducted by state-owned M&D companies; bulk transport is carried by the state's Bangladesh Railways or by privately-owned coastal tankers that actually operate under the umbrella of the Tanker Owners' Association.

BERC regulates power and gas prices. While it is also officially in charge of setting oil prices, practically the responsibility is de facto with the government.

We recommend that BERC be in charge of the whole process of revamping the price structure, once the government, as the policy maker, has agreed to do so. BERC should then be entrusted with the following tasks:

- Monitor the evolution of international oil prices (crude and products), and determine the average landed price of the imported products regularly (monthly basis);
- Determine the technical costs of the operators in charge of the domestic elements, including transport, storage, marketing and distribution of oil products;
- Set regulated prices (or maximum chargeable rates) for these activities, which should reflect the real technical costs of each activity, with no consideration to any political or social objective;
- Review the technical costs on a regular basis (it is commonly done every 3 or 4 years) in order to take into account the general evolution of the costs over time;
- Review with the operators the financial impact of any large-size investment that may require that a given tariff be adjusted;

- Set end user prices by the addition of international price and domestic elements

LPG

The development of LPG should become a 'national objective', so as to allow LPG to efficiently substitute for natural gas deficit in the households.

Pricing and taxes

We propose that the subsidies, which prove to be largely inefficient (at the end of the day the subsidies do not benefit the targeted population), be progressively removed and that all LPG be sold at real prices. In the mean time, related measures should be devised and implemented in order to curb end user prices and make LPG more affordable (see below).

Moreover, decreasing overall government take would materialise a strong government policy in favour of LPG development. Financial simulations need to be performed to determine (i) which type of tax should be decreased or eliminated; (ii) to which level these taxes should be curbed; and (iii) to which extent the elimination of current subsidies would compensate (at least partially) the required government effort.

Financing upfront investment

In many developing countries studies show that the real obstacle to LPG development is the cost of the equipment (bottle, burners, hose, first LPG load) rather than the price of LPG itself. A financial tool should be devised to allow targeted populations (middle and lower-middle income groups) to permanently shift from kerosene, biomass or even natural gas to LPG. Such tool could be in the form of pre-financing a substantial part of the upfront installation (supplied at a nominal fee to households to avoid wastage) and recovering the loan through monthly instalments paid on every LPG load over a medium term period (say, 24 to 36 months). The pre-financing would be funded by the government through either its own budget or a credit from an MFI such as ADB. The amount to be borrowed is reasonable (e.g. 7 million USD for a batch of 100,000 households equipment).

Urban regulation

In addition to individual equipment, the development of LPG should be encouraged in multi-storied buildings and compounds. This can be done through devising specific regulation that encourages the installation of LPG equipment in new buildings (residential buildings as well as private and government commercial premises, such as hotels, hospitals, community buildings) from the outset. It could be made compulsory that both private and government developers install LPG equipment (service line, internal piping, LPG container and loading area, meters and regulator) in newly built or refurbished buildings, so as to be ready for bulk LPG service. Such regulation should be accompanied by a set of appropriate technical and safety regulation.

1. Introduction

The introduction summarises the main findings of the Assessment Report.

1.1 Storage

Lack of storage capacity is a very pregnant issue in Bangladesh. It mainly – but not only – concerns the three transfer depots of Godnail, Fatullah and Daulatpur, i.e. these depots that both serve local consumers and also play the role of hubs for the three Marketing companies, e.g. Padma Oil Company Ltd (POCL), Meghna Petroleum Ltd (MPL) and Jamuna Oil Company Ltd (JOCL). From these hubs the oil products received from the Main Installations (MIs), all located at Chittagong, by coastal tankers are forwarded to local depots further upstream by shallow draft tankers (SDT), train or tank lorries. Two products are at stake: diesel oil and jet fuel.

The demand of diesel oil is tightly linked to the needs of the agriculture and transport sector. It doubles during the dry season in those areas where cultivation requires intensive irrigation provided by diesel-run (and electricity) pumps, e.g. in the greater Rajsahi division. The seasonal swing hits particularly the storage capacity of the Godnail and Fatullah depots, which also supply the Baghabari depot. In these two depots, the number of average days of storage, which is already low in the wet season (no more than a week), falls to around 4 days in the dry season. This figure is well below what a smooth and efficient operation requires, in particular whenever insufficient river draft in the Jamuna and Boral rivers prevents Shallow Draught Tankers (SDT) from supplying Baghabari for days or weeks. The situation at Daulatpur, which feeds four northern depots by rail, while less dramatic, is also worrying.

The storage capacity of jet fuel in the Dhaka area is definitely insufficient. With 4 days of storage in Godnail and 4 days at the airport (KAD) depot, the capacity needs to be substantially increased, as evidenced by events in September 2010 that have demonstrated the high vulnerability of jet fuel supply to external movements.

The demand of fuel oil is expected to rise very sharply from about 0.3 million tons in FY2009-10 to 2.4 million in 2015, 3.6 million in 2020 and 7.2 million in 2030, due to the addition of new power plants based on FO. But its storage infrastructure is now confined only to Chittagong, Dhaka and Khulna areas. Only one private sector company, KPCL, currently has a power plant based on imported FO, though scope for such import is open to others. Large facilities for import, storage and distribution of FO (as well as diesel oil) need to be developed rapidly to meet such an increasing demand.

The number of storage sites and depots is important in a country with a surface area of 160,000 km^2. With 23 storage sites and 50 depots (most storage sites shelter the depots of two or three M&D companies) the country is seemingly fairly well covered. However, the geographical repartition of the storage sites, inherited from the pre-independence marketing structure, may no longer reflect the current and future needs of the country. While the density of storage sites is particularly high in the East and Northeast, vast areas in the North and the Southwest remain supplied by depots located several hours away from a depot, which does not optimize the integrated delivery system.

All depots are far from being able to store (hence, to sell) the complete range of products. Indeed, only diesel is available at every single storage site, and kerosene can be found almost everywhere. Conversely, regular gasoline (MS) is not available at many locations, including Ashuganj, Bhairab and most depots in the Northwest. Premium gasoline (HOBC) is not stored in those sites where regular gasoline is not available, as well as in additional locations such as Barisal and Jhalakati. Fuel oil is absent almost everywhere, except in the Dhaka and Khulna areas.

Finally, Bangladesh lacks emergency, or strategic, storage. The EPOL (where 'E' stands for Emergency) facility has a mere 3,500 tons storage capacity, and is actually mainly used by the Military. Bangladesh needs to design and implement an efficient emergency storage policy. As per National Energy Policy, the strategic stock of petroleum products is to be 60 days consumption spread all over the country.

1.2 Transportation

The transport of oil products between the MI and depots, or between transfer hubs and regional depots, suffers from several drawbacks. Marine and waterways transport account for 86% of oil transport. It benefits from a large – indeed oversized – number of coastal tankers that is currently more than sufficient to supply the main marine routes. However, with rocketing oil demand, in particular fuel oil for power generation (which cannot be moved by pipeline), the transport demand will rapidly exceed the availability of both coastal and shallow draft tankers.

Insufficient dredging of both river channels and unloading sites at many depots do not enable marine transport to take full advantage of this cheap, efficient – and perfectly suitable for Bangladesh -- means of transport.

With 14% of all oil products moved across Bangladesh, railway transport accounts for a modest share of the overall movements. However, rail transport is highly strategic as it is the only way to reach many depots, in particular in the greater Rajshahi Division where siltation and scarce water flow in the Jamuna and Padma river systems have dramatically reduced, if not halted, navigability. Railways suffer from a recurrent shortage of engines and wagons, in particular in the meter gauge system, and from the near saturation of the Chittagong-Akhaura section of the eastern corridor. In addition, technical problems on the Jamuna Bridge reportedly limit the number of trains allowed to cross the bridge.

The doubling of the Chittagong-Tongi meter gauge line is partly done; its completion would bring a much-needed relief in a corridor that accounts for 40% of the overall railway traffic in Bangladesh. Also, announcements are made periodically by Bangladesh Railways (BR) on the procurement of additional engines and wagons, including tanker wagons.

Improving the transportation system has become a sheer necessity, considering the enormous additional volumes of fuel oil and diesel oil that the implementation of oil-run power plants has already started to generate. The time has come to revive a long standing project and to seriously consider building a dedicated products pipeline from Chittagong to the Dhaka area. While such a pipeline will not be able to carry heavy fuel oil – due its high viscosity – the requirements for middle distillates and light products fully justifies the implementation of this type of infrastructure.
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Production, imports, main storage and dispatch facilities are concentrated in one single spot. Every single drop of oil consumed in Bangladesh, except a small quantity available from the gas field plants in the Northeast has to travel through Chittagong, and there is currently no other way around. While the physical patterns of the country have obviously decided of such a de facto monopoly, it puts the security of supply of the country at risk. There is clearly a need for a second port of entry in Bangladesh, in particular because the upside potential for additional infrastructure in Chittagong is no longer commensurate with the strong development of the oil market. The port of Mongla is an option, but accessibility is constrained by the 5.5-meter (18 ft) draught available along the 100-km long channel that connects the port to the Bay of Bengal. The maximum capacity of the ships is reportedly 4,000 tons.

1.3 Non Technical Issues

The distribution margins constitute the original stream of revenues of the oil companies. Their level is fixed by the government; the oil companies have no bearing whatsoever on them. Margins have been historically set at a low level to maintain low prices of oil products, thus transferring the responsibility of the social policy wanted by the government onto the oil companies. The same goes for railways transport tariffs, which have also been set at low levels and have not been adjusted for years, thus depriving BR from the resources required to develop transport supply.

A major consequence is that the oil companies are not financially capable of initiating and implementing an investment policy of their own. Developing and improving infrastructure to meet the growing requirements of the industry currently implies for the companies to go through complex and lengthy investment procedures in order to have access to Government money, which severely constrains their ability to be responsive to new challenges and strongly hampers their operating efficiency.

Another adverse effect of maintaining low margins is that the oil companies can only survive by developing in newly opened markets, e.g. lubricants, where they have proved fairly successful, in particular in the upper tier lubes market. While market opening and competition are certainly an efficient and desirable way for oil companies to diversify their business, it is not economically healthy to institutionalize within a same company a system whereby a purely commercial, profit-making activity heavily cross-subsidizes a strategic, but loss-making activity. The risk is dual: on the one hand the more profitable activity may draw all attention and resources from the company's management and leave the less profitable activity just bare-bone; on the other hand the non profitable activity becomes highly dependent on the results of the commercial activity, hence very vulnerable to any downturn of that activity. Oil companies should be given sustainable, appropriate resources that be genuinely generated by the operation of their strategic activity, i.e. the marketing and distribution of *all* oil products

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2. Storage

2.1 Oil Demand

The recommendations concerning the requirements of storage capacity as well as transportation capacity are based on the projections of the oil products demand presented in Section 2 of Chapter 2 of the Assessment Report. This section presents a brief reminder of the main results of the market analysis.

While the global projections have not been modified (the basic scenario, hence the figures, remain unchanged), the presentation of the results has been adjusted to the purpose of the recommendations.

2.1.1 Territorial breakdown

The future storage (and transportation) requirements need to be established on a geographical basis. One way to do it would be to keep the current network of storage sites, and to allocate the growth of demand to each existing depot. However, the current network of 23 storage sites (gathering 50 depots) is largely inherited from the pre-Independence times and may not be the most efficient. It would not be appropriate to keep it unchanged.

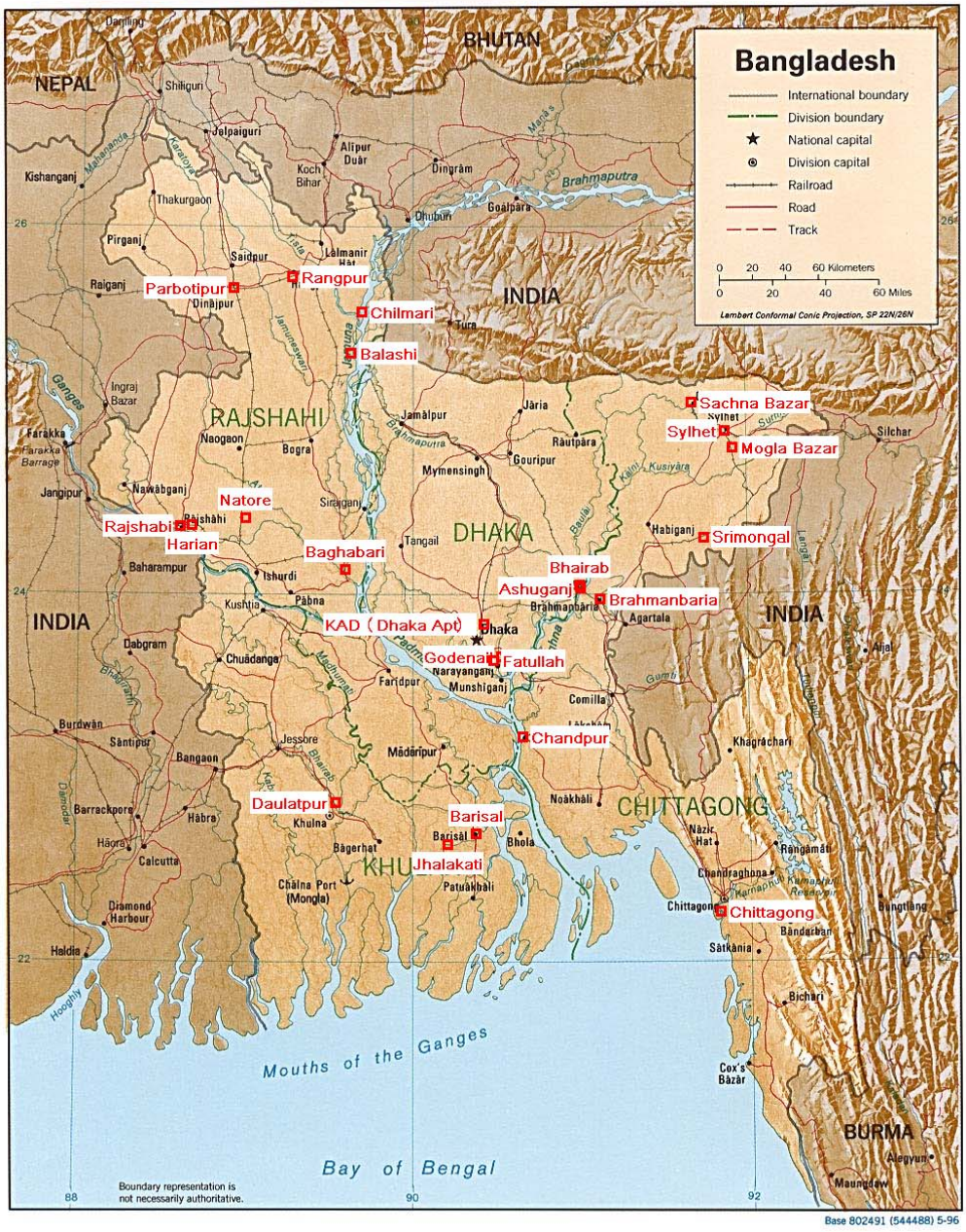
For the purpose of the study we have 're-organised' the territory of Bangladesh into nine 'storage areas', on a geographical basis. All the national territory is covered; each area gathers a certain number of depots that are aggregated to form an area, and every existing depot finds a place in one of them. The demand has been assessed for each area on the basis of the actual sales made by each depot.

The storage areas are the following:

Table 2.1 – Coverage of the Storage Areas

Storage Areas	Storage Sites
Southeast	Chittagong (MI)
Greater Dhaka	Godnail, Fatullah, EPOL
East Central	Chandpur, Ashuganj, Bhairab, Brahmanbaria
Northeast	Sylhet, Mogla Bazar, Sachna Bazaar, Srimongal,
West Central	Baghabari
Northwest	Parbotipur, Rangpur, Balashi, Chilmari
West	Rajsahi, Natore, Harian
Southwest	Daulatpur
South	Barisal, Jhalakati

Location of M&D Depots



2.1.2 Impact of power generation

The oil demand is expected to double in just a few years, and reach 7.8 million tons in 2015, 10.5 million in 2020 and 18.5 million in 2030. The driving force will be the power generation sector, which will require substantial volumes of oil products (fuel oil and, albeit to a lesser extent, diesel) to make up for the declining supply of natural gas. The oil demand for power should reach 3.1 million tons in 2015, 4.6 million in 2020 and 9.5 million in 2030, i.e. roughly half the total demand.

In respect of storage the requirements of the power sector need to be addressed in a different way. Most power plants are (or will be) located close to a waterway or a railway line, in order to avoid engaging a huge fleet of tank lorries. Power operators build and operate their own storage tanks, river jetty and / or railway siding, which enable them to be supplied directly from the Main Installations and transfer depots, although the commercial operation is handled by the nearest sales agency of the supplying M&D company.

Therefore the requirements of storage capacity have been determined for each main group of consumers:

- General consumers (all[1], except power), who do not have their own storage facilities and need to be supplied through a regional depot; and
- Power generation operators, who are deemed to operate their own storage facility.

This general rule is suitable to evaluate the preliminary storage requirements at the 'large scale' level required by this study, and to assess and identify the gaps between the current situation and the future needs. In fact, several factors may lead to make the final requirements somewhat larger – or smaller. One factor is that some power operators, although equipped with storage tanks, may not be reached directly from the MI, whether by coastal tanker or rail, because the location of the plant site requires bi-modal transport. As a consequence they may have to get their oil transferred through a hub depot. This is for instance the case of those power stations that are supplied by rail out of Daulatpur (e.g. Bheramara) or by shallow draft tanker (SDT) out of Godnail / Fatullah (e.g. Gorasal). In such cases the hub depot where the oil product has to be transferred from coastal tanker onto rail or SDT needs to store, as least for a while, the volumes in its own facility prior to re-sending it further upstream.

While the above factor tends to increase the real storage needs of the M&D companies, a second one is conversely likely to reduce them. Depleting gas reserves will increasingly lead many large-size industrial units to shift to oil products, and new plants to resort to use oil in lieu of gas. This may be the case, for instance, for fertilisers plants that are designed to use gas for the non-energy process but can use oil for their pure thermal needs. Depending on their consumption some larger plants will be able to build and operate their own oil storage facility and receive oil directly from the MI, much like a power plant.

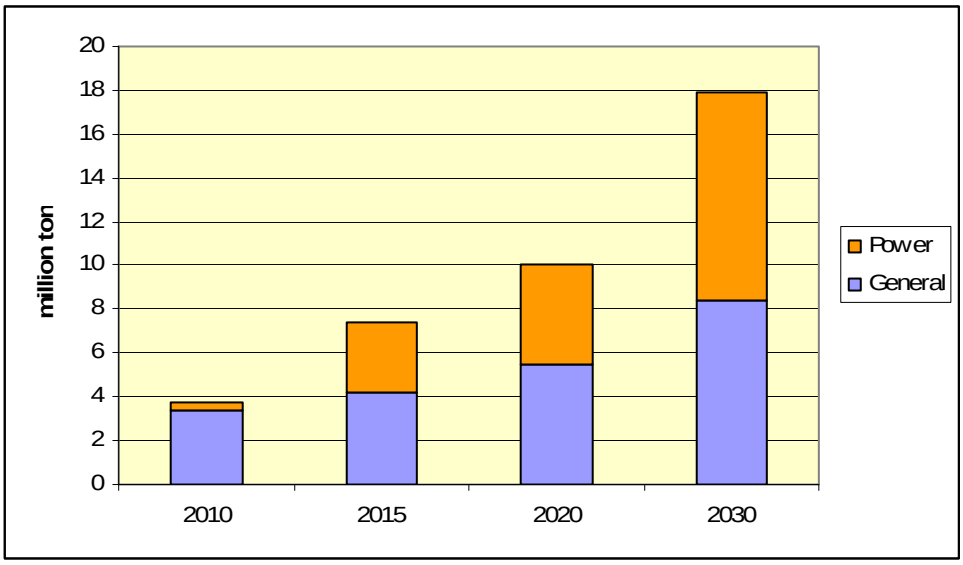
In the near future, we highly recommend that an in-depth evaluation of the needs be undertaken to quantify the detailed storage requirements. .

[1] Transportation, residential & commercial, agriculture, industry.

2.1.3 Demand projections 2010-2030

Figure 1.2 below presents the projected long term evolution of the demand, for both general and power consumers, at country level. The graph clearly shows the rocketing share of power generation in the evolution of the oil demand.

Figure 2.2 – Oil Demand Projections, 2010-2030



2.1.4 Demand in 2020 (country-wide)

For the purpose of the study we have evaluated the storage and transport capacity requirements for one typical year, for the main six products[2] that are stored in the depots of the M&D companies (MS, HOBC, kerosene, jet fuel, diesel and fuel oil). We have selected **year 2020 as target year** in order to assess these requirements in the medium term.

Table 2.3 and Figure 2.4 below show the main characteristics of the Bangladesh market in that year:

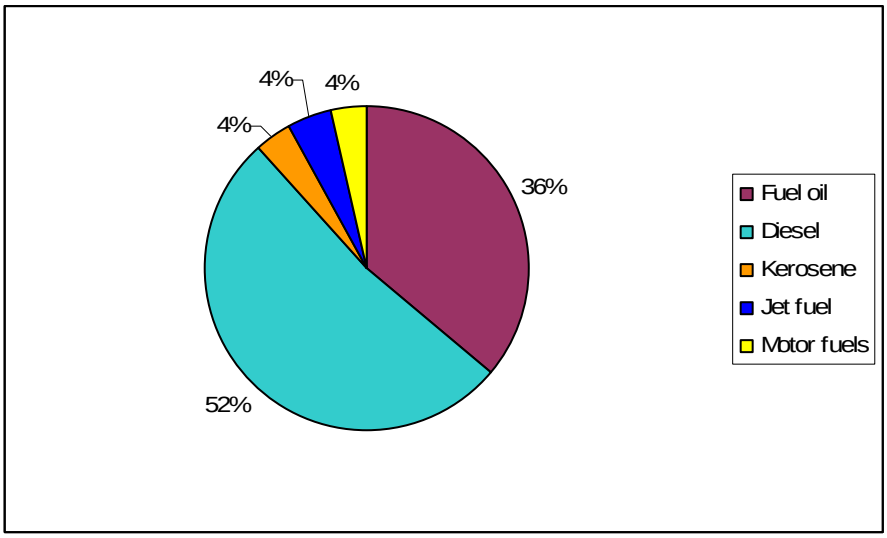
- Diesel remains by far the most demanded product. The demand of the main usages (transport and agriculture) is complemented by the more recent needs of the power sector;
- Fuel oil demand soars, boosted by power requirements; from a position of net exporter by the end of the 2000's, Bangladesh becomes a major fuel oil importer in less than a decade;
- Power generation needs account for almost half the total demand; they are mostly met by fuel oil;
- Other middle distillates (kerosene and jet fuel) as well as light automotive products (MS and HOBC – regular and premium gasoline) account for a mere 4% each.

[2] LPG is analysed in Section 6 of this Report.

Table 2.3 – Oil Products Demand in 2020 (thousand tons)

Oil products	*General Users*	*Power Generation*	*Total*	Share of Power
MS	201		201	
HOBC	152		152	
Diesel	4,004	1,265	5,269	24.0%
Kerosene	377		377	
Jet Fuel	446		446	
Fuel oil	269	3,355	3,625	92.6%
TOTAL	**5,449**	**4,620**	**10,069**	**45.9%**

Figure 2.4 – Oil Products Demand, Product-wise, 2020



2.1.5 Demand in 2020 (area-wise)

The area-wise demand has been estimated on the basis of the real sales in FY2009-10, with two adjustments:

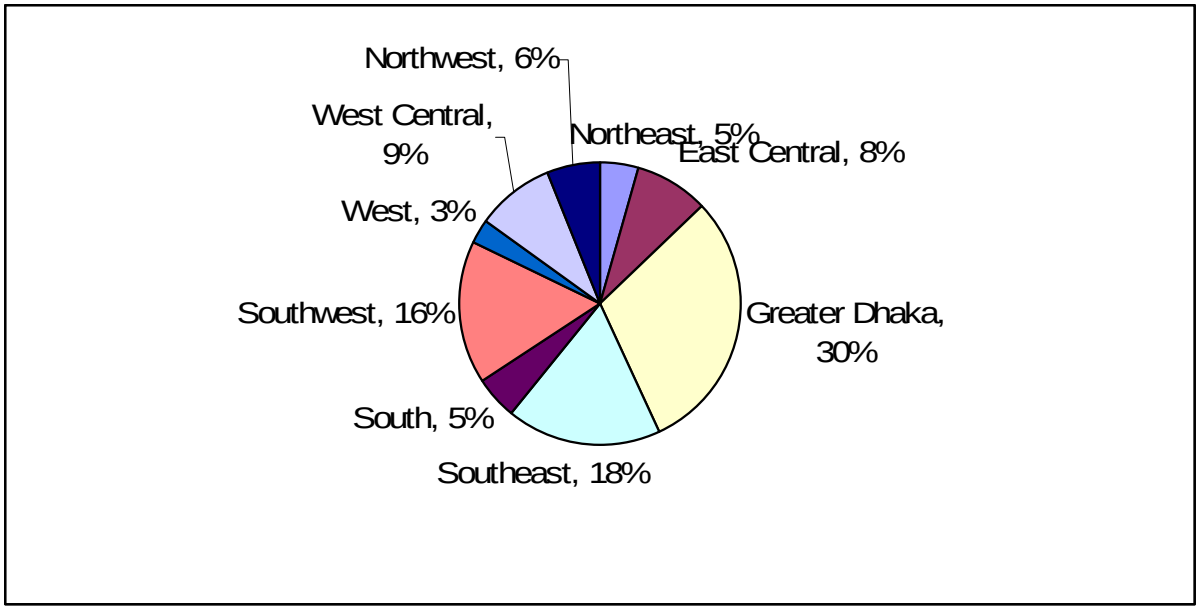
- They **do not include the fuel requirements for power generation**, which will be analysed separately (see Section 2. 3 below);
- For jet fuel we consider that the Sylhet depot will be built in the mean time, therefore some jet fuel will be sold in the Northeast area.

Table 2.5 and Figure 2.6 present the breakdown of the demand of the general consumers (i.e. not included power generation) into the nine storage areas. Storage areas are listed from Northeast to Northwest, geographically clockwise.

Table 2.5 – Oil products Demand 2020, Area-wise (without power)(thousand tons)

Storage Areas	*HOBC*	*MS*	*SKO*	*HSD*	*FO*	*JET*	TOTAL
Northeast	5	17	25	182		18	**247**
East Central	2	4	72	370			**448**
Greater Dhaka	94	42	89	1,043	23	356	**1,647**
Southeast	29	11	55	593	219	67	**973**
South		15	29	226			**270**
Southwest	15	43	42	762	28	4	**893**
West			9	143			**152**
West Central	8	53	29	389			**480**
Northwest		16	27	297			**340**
TOTAL	**152**	**201**	**377**	**4,004**	**269**	**446**	**5,449**

Figure 2.6 - Oil products Demand 2020, Area-wise (without power)



2.1.6 Movements in 2020 (area-wise)

To assess the requirements of storage capacity, one must consider the overall quantities of products passing through the storage tanks.

Due to the route structure of the distribution of the oil products in Bangladesh, depots may have to handle two types of products (all received from MIs), depending on their destination:

- Products intended to be sold in the local market, and
- Products that just pass through the depot prior to being forwarded to their final destination, farther upstream.

Four depots play the role of hub, i.e. they handle products both for local sales and as transfer points: MI in Chittagong (Southeast), Godnail and Fatullah (Greater Dhaka) and Daulatpur

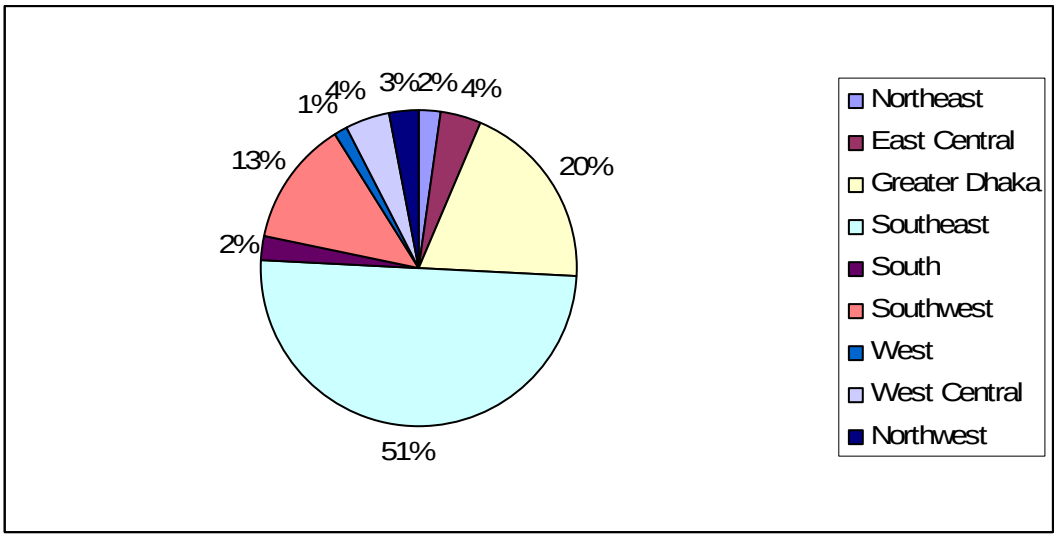
(Southwest). In these hubs the movements generated by the transfer activity is generally important, not only at MIs (where local sales account for only 18% of total send-out) but in Daulatpur (where 35% of the volumes received are transferred up north by rail), and, to a lesser extent, in Godnail and Fatullah (23%, mainly to the West Central area). In total, overall oil movements (for general users) are about twice as large as local sales; the storage (and transportation) infrastructure needs to be tailored to handle 11 million tons (without power needs) while local sales amount to half this figure (5.4 million tons).

Table 2.7 and Figure 2.8 present the breakdown of the demand of the general consumers, still without power needs, into the nine storage areas.

Table 2.7 – Oil Products Movements 2020, Area-wise (without power)(thousand tons)

Storage Areas	*HOBC*	*MS*	*SKO*	*HSD*	*FO*	*JET*	TOTAL
Northeast	5	17	25	182		18	**247**
East Central	2	4	72	370			**448**
Greater Dhaka	102	95	119	1,432	23	356	**2,127**
Southeast	152	201	377	4,004	269	446	**5,449**
South		15	29	226			**270**
Southwest	15	59	77	1,202	28	4	**1,384**
West			9	143			**152**
West Central	8	53	29	389			**480**
Northwest		16	27	297			**340**
TOTAL	**284**	**460**	**763**	**8,244**	**320**	**824**	**10,895**

Figure 2.8 - Oil Products Movements 2020, Area-wise (without power)



2.2 Storage Requirements (without Power Needs)

The existing storage capacity in Bangladesh is far from being able to meet the significantly increasing oil products demand. The Assessment Report (in Chapter 4, Section 1.2) has highlighted some worrying weaknesses in respect of some key products (diesel, jet fuel) and depots (KAD, Godnail / Fatullah, Daulatpur), as well as the lack of any storage for light motor fuels in vast areas, including North Bengal and the East Central area. M&D companies have already started to improve the situation by adding, or expanding the capacity of a few tanks in some depots, and tackling the ever-worrying situation of jet fuel storage and supply in the Greater Dhaka area. However, the efforts that have been engaged fall short of bridging the gap between the requirements of the market and the available infrastructure.

The storage requirements have been assessed for each main product and storage area, for years 2010 (current situation) and 2020. To determine the minimum storage needs we have considered two options, each one corresponding to a specific situation:

- The first option considers the storage capacity required by the M&D companies for their **day-to-day operation** in a regular technical, economic and political environment. It is generally considered that operators need a storage capacity ranging between 10 and 14 days of average daily consumption in order to run efficiently their operation. In Bangladesh, where the transportation of liquid fuels (and all kinds of goods as well) is uneasy, we have considered the upper value, i.e. **a standard ADS[3] of 14 days** for all depots. An "ADS-14" means that the capacity of any depot must allow to supply the demand for at least 14 days, for every product.
- The second option considers that Bangladesh needs to implement, beyond the basic operating storage needs, a **strategic storage policy** that enables the country to cope with any unpredictable situation, which may be caused by either internal or international events, such as e.g. a drop in oil production or unprecedented climatic conditions. Many countries have already developed such strategic storage policies, where requirements usually range from 60 to 90 days of average consumption. While it is desirable that Bangladesh reach such standards in the future, we have followed, in a first step, the recommendation made by BPC and considered an **ADS of 30 days,** which we have applied to all depots.

2.2.1 Operational Requirements (ADS-14)

Short Term Measures

Key figures in this section summarize the current situation previously described and discussed in more detail in the Assessment Report. Figures have been aggregated by storage areas and will serve as a reference to assess (in the following section 2.2) the volume of storage capacity that should be added to the 2010 infrastructure in order to meet the 2020 requirements.

Tables 2.9 and 2.10 below present the reference data for 2010.

[3] ADS: Average Days of Storage, i.e. the number of days that it takes to empty out a full tank. It is measured by the ratio of the net capacity storage to the *average* daily flow (yearly movements divided by 365).

Table 2.9 – Existing Storage Capacity at M&D depots[4], 2010 (tons)

Storage Areas	HOBC	MS	SKO	HSD	FO	JET	TOTAL
Northeast	699	1,369	2,918	4,009			**8,995**
East Central	30	593	5,399	8,457			**14,479**
Greater Dhaka	3,316	3,074	4,312	17,719	3,116	2,900	**34,437**
Southeast	9,533	16,863	47,596	114,459	36,620	24,220	**249,291**
South		523	2,920	6,323			**9,766**
Southwest	1,020	2,340	4,580	17,383	3,746	415	**29,484**
West			130	870			**1,000**
West Central	458	1,799	4,113	33,042			**39,412**
Northwest	35	343	2,584	11,249			**14,211**
TOTAL	15,091	26,904	74,552	213,511	43,482	27,535	**401,075**

Table 2.10 – Current Storage Requirements, ADS-14, 2010 (tons)

Storage Areas	HOBC	MS	SKO	HSD	FO	JET	TOTAL
Northeast	115	410	947	4,489			**5,961**
East Central	34	101	2,746	9,108			**11,989**
Greater Dhaka	2,204	2,321	4,585	35,645	626	9,253	**54,634**
Southeast	3,281	4,881	14,447	98,505	7,447	11,006	**139,566**
South		357	1,122	5,549			**7,028**
Southwest	314	1,427	2,879	28,758	764	33	**34,176**
West			343	3,508			**3,850**
West Central	178	1,293	1,131	9,559			**12,161**
Northwest		393	1,022	7,304			**8,718**
TOTAL	6,124	11,183	29,222	202,425	8,838	20,292	**278,084**

Main findings:

- At country level, the current situation gives a rather optimistic signal: the overall storage capacity exceeds by far the overall requirements;
- Storage capacity definitely exists, but not necessarily where it should be, nor necessarily for the right products. The area-wise analysis shows that the impressive 123,000 tons excess capacity is mostly located at MI (110,000 tons) and Baghabari (27,000 tons). But it does offset the real capacity shortage recorded in the Greater Dhaka area (--20,200 tons overall) and, to a lesser extent, in the Southwest (Daulatpur) and Western areas;
- Two products are at stake: diesel and jet fuel.

Table 2.11 below allows for further refining the analysis. The last two columns and rows (Net Total and Gross Total) show two types of figures that seem conflicting:

[4] i.e., not including storage at ERL, Chittagong.

- The 'Net Total' figures show a large excess situation (123,000 tons). The Net Total gives, for a given area (column) and a given product (row), the net storage situation (net surplus or deficit). For instance, there is a net capacity surplus in the Northeast (5 depots) because the deficit in diesel storage is offset by excess capacity for the other 5 products. Conversely, there is a net deficit in the Greater Dhaka area, where limited excess capacity of motor fuels and fuel oil is well smaller than the deficit of the other products. Indeed, in a given area, the Net Total situation reflects the minimum additional capacity that must be built, could the tanks of a product with excess storage capacity be converted to store another product for which storage is insufficient. This is the case, for instance, in the Northeast and East Central areas (which show a net surplus situation), where excess kerosene storage could be used to compensate for missing storage capacity of diesel;
- Conversely, the 'Gross Total' figures show a deficit of 40,000 tons. Gross Total shows the capacity that should be added in a given area, irrespective of the excess capacity that may exist within this area for other products. It reflects the maximum additional capacity that must be built, should no conversion of tanks be possible. However, there remains some flexibility in those areas that are supplied through several depots, e.g. the Northeast and the Northwest areas, where additional capacity can be build in the most appropriate site.

Table 2.11 – Existing Storage Surplus and Deficit, ADS-14, 2010 (tons)

Storage Areas	HOBC	MS	SKO	HSD	FO	JET	NET TOTAL	GROSS TOTAL
Northeast	584	959	1,971	-480			3,034	-480
East Central	-4	492	2,653	-651			2,490	-655
Greater Dhaka	1,112	753	-273	-17,926	2,490	-6,353	-20,197	-24,552
Southeast	6,252	11,982	33,149	15,954	29,173	13,214	109,725	
South		166	1,798	774			2,738	
Southwest	706	913	1,701	-11,375	2,982	382	-4,692	-11,375
West			-213	-2,638			-2,850	-2,850
West Central	280	506	2,982	23,483			27,251	
Northwest	35	-50	1,562	3,945			5,493	-50
NET TOTAL	**8,967**	**15,721**	**45,330**	**11,086**	**34,644**	**7,243**	122,991	-39,963
GROSS TOTAL	**-4**	**-50**	**-485**	**-33,070**		**-6,353**	-39,963	

At this stage, we recommend that the M&D companies implement a **short term Plan of Action** that would include, subject to further in-depth review:

- The M&D companies need to **build or convert about 40,000 tons of storage capacity**, mainly for diesel and jet fuel, in the Greater Dhaka and Southwest areas;
- In the Northeast and East Central areas, excess kerosene storage capacity could be allocated to diesel to offset the current, limited diesel deficit;
- In the Greater Dhaka area, deficit dominates for most products. There is an urgent need first to add diesel and jet fuel storage capacity, to be followed by kerosene. The situation of motor fuels should be monitored carefully, should the restrictive policy that currently prevails for CNG be pursued. The same goes for fuel oil, whose demand is expected to grow due to increasing gas shortage;

- In the Southwest area the situation is generally tight for diesel, and worsens in the dry season. Additional storage capacity is urgently required;
- The Western area suffers from a structural storage deficit, as oil products are supplied through railhead depots with no storage capacity, except limited volume in Natore. This is a matter of policy that requires further focus and discussion within M&D companies. The issue will be addressed in the following section (medium term actions). There is no short term action to be undertaken;
- The other areas are on the safe side. The MI displays a very healthy situation (+110,000 tons with satisfactory balance between products), and the same goes for the West Central area. In particular, the well-distributed excess capacity at Baghabari does not, under regular supply conditions, call for the construction of additional capacity.

Medium Term Measures (2020)

As could be expected the storage requirements will significantly increase over the 2010 -2020 period as the demand develops (5.5 million tons, not including power generation needs), from 278,000 tons in 2010 to 418,000 tons in 2020 (see Table 2.12 below). Over three-fourths are intended for diesel storage.

Table 2.12 – Storage Requirements, ADS-14, 2020 (tons)

Storage Areas	HOBC	MS	SKO	HSD	FO	JET	TOTAL
Northeast	204	647	947	7,000	0	684	**9,481**
East Central	60	160	2,745	14,202	0	0	**17,167**
Greater Dhaka	3,918	3,661	4,554	54,910	869	13,672	**81,583**
Southeast	5,833	7,700	14,445	153,592	10,334	17,089	**208,993**
South	0	564	1,122	8,652	0	0	**10,337**
Southwest	558	2,251	2,966	46,095	1,060	171	**53,101**
West	0	0	342	5,469	0	0	**5,812**
West Central	316	2,040	1,131	14,905	0	0	**18,392**
Northwest	0	620	1,022	11,388	0	0	**13,030**
TOTAL	**10,889**	**17,643**	**29,274**	**316,213**	**12,262**	**31,616**	**417,896**

The Net Total additional capacity required reaches 17,000 tons, countrywide (see Table 2.13 below). However, as discussed in the previous section, this rather low figure does not translate the real situation of the storage deficit, due to imbalances between products and between areas. Indeed, the Gross Total requirements give a more appropriate figure of the deficit situation. With required additions of 135,000 tons, the M&D companies need to convert or build about 15,000 tons of new capacity every year up to 2020. And this does not include possible additional requirements for power operators. Most of this new capacity is intended for diesel (121,000 tons) and jet fuel (11,000 tons), and is to be built mainly in the Greater Dhaka and Southwest areas.

Table 2.13 – Storage Capacity Surplus and Deficit, ADS-14, 2020 (tons)

Storage Areas	HOBC	MS	SKO	HSD	FO	JET	NET TOTAL	GROSS TOTAL
Northeast	495	722	1,971	-2,991	0	-684	-486	-3,675
East Central	-30	433	2,654	-5,745	0	0	-2,688	-5,774
Greater Dhaka	-602	-587	-242	-37,191	2,247	-10,772	-47,146	-49,393
Southeast	3,700	9,163	33,151	-39,133	26,286	7,131	40,298	-39,133
South	0	-41	1,798	-2,329	0	0	-571	-2,370
Southwest	462	89	1,614	-28,712	2,686	244	-23,617	-28,712
West	0	0	-212	-4,599	0	0	-4,812	-4,812
West Central	142	-241	2,982	18,137	0	0	21,020	-241
Northwest	35	-277	1,562	-139	0	0	1,181	-416
NET TOTAL	4,202	9,261	45,278	-102,702	31,220	-4,081	-16,821	-134,526
GROSS TOTAL	-632	-1,146	-454	-120,839		-11,455	-134,526	

The **medium-term Action Plan** is obviously much more ambitious than the short term Plan. The M&D companies will need to convert or build 135,000 tons of new capacity in about 9 years, i.e. 95,000 tons on top of the short term Plan requirements (there again, subject to further in-depth review). All areas need to some extent to be re-enforced, and all products are concerned, except fuel oil (for the general users).

Depending on their size and surplus / deficit status, the infrastructure to be added in the storage areas vary significantly. Storage areas may be broken down into four typical categories, ranging from the most sound to the most critical situation:

- **Type 1** qualifies an area where storage capacity is adequate and is expected to remain so over the decade under normal supply conditions. This is the case of the *West Central* area (Baghabari), where the existing capacity (close to 40,000 tons) is able to take care of the 480,000 tons that the depot is expected to handle in 2020. In addition, the breakdown of the tanks into products is also adequate; there is no strong imbalance as it can be found in many other depots, in particular for diesel. Only regular gasoline (MS) will face shortage capacity in the second half of the decade.
- **Type 2** includes four small- and mid-size storage areas, with around 10,000-15,000 tons of storage capacity as of now (*Northeast, East Central, South* and *Northwest*), and the *Southeast* (the large MI at Chittagong). All areas already face, or will face storage shortage over this decade, in particular for diesel. They also enjoy significant kerosene surplus capacity, a situation that is expected to remain unchanged until at least 2020. Kerosene surplus in 2020, however, will be smaller than additional diesel requirements. Part of the additional diesel needs could be met through the conversion of unnecessary kerosene tanks, complemented by the construction of new diesel capacity. In addition to diesel, other products will need to get new or expanded storage capacity, such as jet fuel at Sylhet airport and at a depot nearby (unless the airport is directly connected to the rail track), should the decision to build a depot at the airport be confirmed. This is also the case of regular gasoline storage that will be lacking in both the South and Northwest areas.
- **Type 3** reflects about the same situation (kerosene surplus available), but the required diesel volumes are much larger. This is the case of the *Southwest* area that will need close to 30,000 tons additional diesel capacity by 2020. Most of it will have to consist of new storage tanks, as surplus kerosene capacity will be much smaller than diesel requirements.
- **Type 4** includes storage areas where capacity is already missing or non-existent. *Greater Dhaka* is already short in diesel and jet fuel. In 2020 storage capacity will be missing for all

products (except FO for general users) and the shortfall is expected to reach 50,000 tons, not including jet fuel at the KAD airport depot. While there is still land available at Godnail, in particular at Padma depot, Fatullah is close to saturation. The question of developing a new site is raised and will need to be answered to before the end of the decade. A similar issue needs to be addressed in respect of the *West* area (Rajshahi-Harian).

Specific Requirements for Some Products

While diesel storage is available at all depots and kerosene at most of them (except railhead depots in the West) storage of some products is severely lacking in areas although the demand is to be found all over the country. This is the case for **light motor fuels** (MS and HOBC). In respect of HOBC only 6 storage sites have substantial storage capacity[5]. Four areas are left without any HOBC storage, including East Central, South, West and Northwest. The situation is particularly critical west of the lower Meghna and Jamuna Rivers, which covers about half the country's area, where HOBC tanks are only available at Daulatpur and Baghabari. The situation is slightly better for MS, but storage is lacking in most of the East Central area and in the West.

In order to get a better territorial coverage, capacity should be added in the short term at:

- Ashuganj or Bhairab, and Parbotipur for both MS and HOBC;
- Sylhet, Chandpur, and Barisal or Jhalakati for HOBC.

In the medium term additional capacity will be required:

- In the Greater Dhaka area for both MS and HOBC;
- In the West Central area for MS.

Jet fuel is mostly consumed in Dhaka, some quantities are also sold at Chittagong (supplied from MI of POCL) and a small volume at Jessore. The jet fuel for Dhaka is sent out by coastal tankers (waterways), to Godnail depot in Narayanganj district, south of Dhaka. It is then moved to Dhaka airport depot (KAD) by tank lorries. The average daily consumption at KAD is about 650 tons crossing 1,000.tons during Hajj season whereas available storage at KAD is only 2,900 tons; Godnail depot also has similar storage capacity. This means, on average, less than 4 days coverage is available at each KAD and at Godnail, and even less than 3 days during Hajj season. There is every possibility of product shortage due to any natural calamity or a man-made situation like that of May 2010, which can disrupt flights involving local and many international airlines.

There is a plan to substantially improve jet fuel supply and storage at KAD (Dhaka) airport. Jet fuel will be transported seamlessly by train (meter gauge) from MI to Airport Railway station close to KAD, from where the product will be transferred through a short pipeline of about one and a half kilometres length to the depot. Such plan, however, is subject to the availability of a great deal of dedicated wagons, engines and train drivers, which is out of the control of POCL, the sole M&D company handling jet fuel. The pipeline option proposed in Chapter 4 of this Report would make jet fuel supply independent of events or operators that are currently out of the control of the M&D companies.

Finally the situation of **fuel oil** storage may become critical in the very near future**.** FO is currently supplied from MIs only to Godnail and Fatullah (Greater Dhaka) and Daulatpur (Southwest), and not to any other depot in the country. While such a situation was not unbearable as long as gas was available to meet the industrial demand, the gas shortage will increasingly cause more existing and future energy-intensive industry turn to an alternative fuel, which can only be fuel oil (and some diesel). Fuel oil demand is therefore expected to develop both in terms of volumes and new territories.

[5] Not including MI and EPOL. These sites are Godnail, Fatullah, Mogla Bazar, Sreemongal, Baghabari and Daulatpur.

Fuel oil storage should be developed in at least one depot of each key storage area so as to cover the whole country. In the short term, fuel oil tanks should be built in the Northwest, West Central, and East Central areas, in order to reduce to a reasonable level the distance of the final leg – where fuel oil has to be transported by tank lorries – between an M&D company depot and the end consumer.

2.2.2 Strategic Requirements (ADS-30)

As can be expected, the new requirements under the ASD 30 option are significantly higher. Indeed, they are slightly above twice as much as under the ASD 14 option and nearly reach 600,000 tons (Table 2.14).

Table 2.14 – Current Storage Requirements, ADS-30, 2010 (tons)

Storage Areas	HOBC	MS	SKO	HSD	FO	JET	TOTAL
Northeast	246	879	2,030	9,620	0	0	12,774
East Central	72	217	5,883	19,517	0	0	25,690
Greater Dhaka	4,722	4,973	9,825	76,382	1,341	19,829	117,072
Southeast	7,030	10,459	30,958	211,081	15,959	23,584	299,071
South	0	766	2,404	11,890	0	0	15,060
Southwest	672	3,057	6,170	61,625	1,638	71	73,233
West	0	0	734	7,517	0	0	8,250
West Central	381	2,771	2,424	20,484	0	0	26,060
Northwest	0	842	2,190	15,651	0	0	18,682
TOTAL	13,123	23,964	62,618	433,767	18,938	43,484	595,893

At country level, storage requirements are well above the current capacity (400,000 tons, see Table 2.9). Deficit exists in almost each of the nine regions, except West Central where an overall surplus of 13,000 tons is still available at Baghabari.

The Net Deficit reaches 195,000 tons and the Gross Deficit nearly 260,000 tons. As far as the latter is concerned, all regions suffer from a deficit for one or several products, including West Central where HSD storage capacity is still satisfactory but a slight deficit shows for MS (-1,000 tons).

Table 2.15 – Existing Storage Surplus and Deficit, ADS-30, 2010 (tons)

Storage Areas	HOBC	MS	SKO	HSD	FO	JET	NET TOTAL	GROSS TOTAL
Northeast	453	490	888	-5,611	0	0	-3,779	-5,611
East Central	-42	376	-484	-11,060	0	0	-11,211	-11,102
Greater Dhaka	-1,406	-1,899	-5,513	-58,663	1,775	-16,929	-82,635	-84,410
Southeast	2,503	6,404	16,638	-96,622	20,661	636	-49,780	-96,622
South	0	-243	516	-5,567	0	0	-5,294	-5,567
Southwest	348	-717	-1,590	-44,242	2,108	344	-43,749	-46,550

West	0	0	-604	-6,647	0	0	-7,250	-7,250
West Central	77	-972	1,689	12,558	0	0	13,352	972
Northwest	35	-499	394	-4,402	0	0	-4,471	499
NET TOTAL	1,968	2,940	11,934	-220,256	24,544	-15,949	-194,818	-258,584
GROSS TOTAL	-1,448	-4,087	-7,707	-228,412	24,544	-16,929	-258,584	

Compared with the ADS-14 option, the situation is obviously much more worrying and the measures to be undertaken are significantly stronger:

- The M&D companies need to **build or convert about 260,000 tons of storage capacity**, mainly for diesel and jet fuel, and all nine regions are concerned. The Southeast area (-97,000 tons) and the Greater Dhaka area (-84,000 tons) show the worst situation, while the Southwest (-47,000) is now severely hit;
- In most regions there remains only very limited excess kerosene or SKO storage capacity that could be converted and allocated to diesel to offset the diesel deficit;
- In the Greater Dhaka area, deficit dominates for all products, except HFO. The urgent need to add diesel and jet fuel storage capacity, followed by kerosene to a lesser extent, is even more pregnant. Motor fuels (MS and HOBC) are in deficit. The situation of fuel oil, whose demand is expected to grow due to increasing gas shortage, should be monitored carefully;
- In the Southwest area large additional storage capacity is urgently required for diesel;
- The other areas are less severely hit. However, the MI shows a strong deficit of diesel (-97,000 tons), as do all other regions except West Central.

In 2020 the overall storage needs will amount to nearly 900,000 tons (Table 2.16), generating a net deficit (compared with the current capacity) close to 500,000 tons and an even larger gross deficit of 533,000 tons.

Table 2.16 – Storage Requirements, ADS-30, 2020 (tons)

Storage Areas	HOBC	MS	SKO	HSD	FO	JET	TOTAL
Northeast	437	1,386	2,030	15,000	0	1,465	20,317
East Central	128	343	5,883	30,432	0	0	36,786
Greater Dhaka	8,396	7,846	9,758	117,663	1,861	29,296	174,820
Southeast	12,500	16,500	30,953	329,126	22,143	36,620	447,843
South	0	1,208	2,404	18,540	0	0	22,152
Southwest	1,196	4,823	6,356	98,776	2,272	366	113,789
West	0	0	734	11,720	0	0	12,454
West Central	677	4,372	2,423	31,939	0	0	39,412
Northwest	0	1,328	2,189	24,403	0	0	27,921
TOTAL	23,333	37,806	62,730	677,599	26,277	67,748	895,492

There again, the **Medium Term Action Plan** is be much more ambitious than the short term Plan. The M&D companies will need to **convert or build 533,000 tons of new capacity** in about 9

years (Table 2.17), i.e. 273,000 tons on top of the Short Term Plan requirements. All areas need to be re-enforced, and all products are concerned, except fuel oil (for the general users).

The Southeast and Greater Dhaka areas account for 69% of the total requirements, followed by the Southwest (16%). Similarly to the ADS-14 option however, all areas need to be strengthened, albeit to a much larger extent. The main findings and recommendations made for the ADS-14 option may be generally kept, with some minor differences:

- In spite of much higher capacity requirements Baghabari (West Central area) may still remain a Type 1 oil depot, although a limited deficit will show in the medium term for MS and HOBC, and additional capacity will be required for diesel by the turn of the decade;
- The smaller depots in East Central, Northeast, Northwest and South areas become Type 3 depots: they still have some surplus capacity in 2020, in particular for SKO, but such surplus is very limited and definitely insufficient when it comes to shift to diesel storage;
- The deficit at larger hubs, including MI (-230,000 tons), Greater Dhaka (-142,000 tons), and Southwest (-86,000 tons), between the real situation (in 2010) and the desirable level of storage is obviously more worrying in the ADS-30 option.

Table 2.17 – Storage Capacity Surplus and Deficit, ADS-30, 2020 (tons)

Storage Areas	HOBC	MS	SKO	HSD	FO	JET	NET TOTAL	GROSS TOTAL
Northeast	262	-17	888	-10,991	0	-1,465	-11,322	-12,456
East Central	-98	250	-484	-21,975	0	0	-22,307	-22,073
Greater Dhaka	-5,080	-4,772	-5,446	-99,944	1 255	-26,396	-140,383	-141,638
Southeast	-2,967	363	16,643	-214,667	14 477	-12,400	-198,552	-230,034
South	0	-685	516	-12,217	0	0	-12,386	-12,902
Southwest	-176	-2,483	-1,776	-81,393	1 474	49	-84,305	-85,827
West	0	0	-604	-10,850	0	0	-11,454	-11,454
West Central	-219	-2,573	1,690	1,103	0	0	0	-2,792
Northwest	35	-985	395	-13,154	0	0	-13,710	-14,139
NET TOTAL	-8,242	-10,902	11,822	-464,088	17 205	-40,213	-494,417	-533,315
GROSS TOTAL	-8,540	-11,498	-7,825	-465,191	17 205	-40,261	-533,315	

2.3 Additional Requirements for Power Generation

Power producers do not require the same storage chain as the 'general' consumers do. Power stations are designed from the outset to include their own storage facilities, including oil tanks and a reception terminal, whether a jetty for those power stations that are supplied by coastal or shallow draft tankers, or a railway siding for those supplied by rail. Oil products are generally received directly from the MIs (and transfer depots) without having to go physically through one of the depots operated by the M&D companies, in order to save on both transportation time and cost.

2.3.1 Storage Requirements at Power Stations

We have determined the storage capacity required at the site of the 38 oil-run power stations that are deemed to be running by the end of 2011, whether they already operate or are under construction or at an advanced stage of design. They include both PDB-operated facilities and IPPs (in particular through the Quick Rental Programme – QRP). Data have been collected and reconciled from various sources (PDB, PowerCell, BPC, M&D companies) and are meant to reflect the situation as of March 2011. However, the context of power generation has been evolving at a very fast pace in the last two years, in particular in the wake of the revision of the PSDP and the launching of the emergency programme; some power plants presented in the following tables may have been shelved or cancelled while new units may have been decided over the past few weeks.

The calculations of storage requirements are based on the design or planned oil consumption of the power stations and a storage-to-consumption ratio. We have considered for the latter **the provision set for the Quick Rental Programme,** which states that **fuel oil-run plants should dispose of at least 15 days of storage at 80% operation.** We consider this value very reasonable and have applied it to all oil-run plants, although QRP requirements are less stringent for diesel-run plants (15 days at 50% operation, because diesel plants are considered to run on a lower load than fuel oil plants).

Table 2.18 shows the summary of the storage requirements at power stations in 2011 and 2020. Power stations will need 37,700 tons storage for diesel by the end of 2011 and 71,200 tons in 2020. Respective figures for fuel oil are 95,200 and 170,000 tons.

Figures show that total existing or planned capacity in 2011 slightly exceeds requirements for diesel (+4,600 tons), and largely exceed the requirements for fuel oil (+71,400 tons). Indeed actual fuel oil storage capacity represents over one month of recorded consumption. Conversely, the situation is much tighter for diesel, in particular when one considers the significantly larger demand that Bangladesh has to meet during the irrigation season. While the security of supply of diesel can be considered satisfactory during the low-demand season, it becomes below standard in the dry season.

Table 2.18 – Total Storage Requirements at Power Stations in 2011 and 2020, ADS-15 (tons)

	2011	2020
Existing or planned capacity		
Diesel	42,300	--
Fuel oil	166,600	--
Capacity requirements		
Diesel	37,700	71,200
Fuel oil	95,200	170,000
Surplus/Deficit		
Diesel	4,600	--
Fuel oil	71,400	--

Option ADS-30

To be consistent with the ADS options considered in the case of regular oil depots, we have determined the storage requirements of the power plants for an ADS-30 option, and the corresponding surplus or deficit situation (Table 2.19).

Table 2.19 – Total Storage Requirements at Power Stations in 2011 and 2020, ADS-30 (tons)

	2011	2020
Existing or planned capacity		
Diesel	42,300	--
Fuel oil	166,600	--
Capacity requirements		
Diesel	75,400	142,400
Fuel oil	190,400	340,000
Surplus/Deficit		
Diesel	-33,100	--
Fuel oil	-23,800	--

Figures show that, in the ADS-30 option, total existing or planned capacity in 2011 is significantly lower than the requirements, for diesel (-33,100 tons), as well as for fuel oil (-23,800 tons).

Table 2.20 hereafter presents the results of the comparison of the requirements[6] with the existing or planned storage capacity, which yields much better figures than M&D companies' depots. Out of 38 power stations, only five present some storage deficit, most of them in diesel, including two PDB-operated plants (Barisal and Rangpur) and three IPPs (NEPC, Khulna and Thakurgaon QRs).

[6] Storage requirements are based on the derated capacity of the plants.

Table 2.20 – Storage Capacity Requirements at Power Stations by end-2011

					Monthly Consump. (tons)				Storage Capacity (tons)		
Storage Area / Power Station	Sponsor / Operator	Capacity (MW)	Fuel Type	Status	Average	Maximum	Location	District	Existing or Planned	Required for 15 days consump. @80% ops	Suplus / Deficit
Greater Dhaka											
Pagla Quick Rental	DPA Power	50	HSD	Operation	3,700	5,900	Pagla	Narayanganj	3,000	2,360	640
Ghorashal Quick Rental	Aggreco	45	HSD	Operation	3,500	19,000	Gorashal	Narayanganj	8,500	7,600	900
Ghorashal Quick Rental	Aggreco	100	HSD	Operation	7,500		Gorashal	Narayanganj			
Siddirganj Quick Rental	Desh	100	HSD	Operation	8,000	*12,800*	Siddirganj	Narayanganj	6,000	5,120	880
NEPC Haripur	NEPC Consortium Power	100	FO	Operation	*8,000*	*12,800*	Haripur	Narayanganj	2,400	5,120	-2,720
Madanganj Quick Rental	Summit	102	FO	Mar-11	8,000	11,800	Madanganj	Narayanganj	7,000	4,720	2,280
Meghnaghat IEL	IEL	100	FO	Mar-11	8,000	11,700	Meghnaghat	Narayanganj	8,000	4,680	3,320
Keraniganj Quick Rental	Power Pack Holdings	100	FO	Apr-11	8,000	11,800	Keraniganj	Dhaka	13,800	4,720	9,080
Meghnaghat Quick Rental	Hyperion	100	FO	Jun-11	8,000	11,800	Meghnaghat	Narayanganj	7,600	4,720	2,880
Siddirganj	Dutch Bangla	100	FO	May-11	8,000	11,700	Siddirganj	Narayanganj	7,600	4,680	2,920
Gazipur Peaking Plant	PDB	50	FO	na	3,800	*6,080*	Kadda	Gazipur	na	2,432	na
East Central											
Daudkhandi 50 MW Peaking Plant	PDB	50	FO	Sep-11	4,000	*6,400*	Daudkandi	Comilla	na	2,560	na
Southeast											
Shikalbaha	Energis	55	FO	na	*4,313*	6,900	Shikalbaha	Chittagong	4,500	2,760	1,740
Dohazari 100 MW Peaking Plant	PDB	102	FO	Aug-11	7,800	10,000	Dohazari	Chittagong	10,000	4,000	6,000
Hathazari 100 MW Peaking Plant	PDB	98	FO	Sep-11	7,700	10,000	Hat Hazari	Chittagong	10,000	4,000	6,000
Julda Quick Rental	Acorn/Bangla Trac	100	FO	May-11	8,000	11,700	Julda	Chittagong	10,000	4,680	5,320
South											
Barisal	PDB	3	HSD	Operation	*305*	*488*	Barisal	Barisal	1,250	2,276	-1,026
Barisal	PDB	32	HSD	Operation	*3,251*	*5,201*	Barisal	Barisal			
Barisal Rental	na	50	FO	na	4,000	*6,400*	Barisal	Barisal	na	2,560	na

					Monthly Consump. (tons)				Storage Capacity (tons)		
Storage Area / Power Station	Sponsor / Operator	Capacity (MW)	Fuel Type	Status	Average	Maximum	Location	District	Existing or Planned	Required for 15 days consump. @80% ops	Suplus / Deficit
Southwest											
Bheramara	PDB	54	HSD	Operation	*5,486*	*8,777*	Bheramara	Kushtia	10,800	3,511	7,289
Bheramara Rental	Quantum Power	110	HSD	Operation	9,000	14,500	Bheramara	Kushtia	6,600	5,800	800
Khulna Quick Rental	Aggreco	55	HSD	Operation	4,100	7,200	Daulatpur	Khulna	1,770	5,480	-3,710
Khulna Rental	Aggreco	40	HSD	Operation	*3,200*	6,500	Daulatpur	Khulna			
Khulna (KPS)	PDB	60	FO	Operation	*6,608*	*10,573*	Daulatpur	Khulna	27,730	6,697	21,033
Khulna (KPS)	PDB	35	FO	Operation	*3,855*	*6,168*	Daulatpur	Khulna			
Faridpur 50 MW Peaking Plant	PDB	54	FO	Aug-11	3,900	6,000	Faridpur	Faridpur	10,000	2,400	7,600
Noapara Quick Rental	Quantum Power	105	FO	Jun-11	9,000	13,370	Noapara	Jessore	6,100	5,348	752
Khulna (KPCL)	KPCL	115	FO	Mar-11	9,000	13,000	Daulatpur	Khulna	15,000	5,200	9,800
Noapara Quick Rental	Khanjahan Ali Power	40	FO	Apr-11	3,500	4,700	Noapara	Jessore	2,500	1,880	620
Gopalganj 100 MW Peaking Plant	PDB	109	FO	Aug-11	7,800	*12,480*	Gopalganj	Gopalganj	10,000	4,992	5,008
West Central											
Baghabari 50 MW Peaking Plant	PDB	52	FO	Sep-11	4,000	*6,400*	Baghabari	Sirajganj	na	2,560	na
Bera 70 MW Peaking Plant	PDB	71	FO	Nov-11	5,400	*8,640*	Bera	Pabna	na	3,456	na
West											
Katakhali 50 MW Peaking Plant	PDB	50	FO	Dec-11	4,000	*5,000*	Kathakali	Rajshahi	na	2,000	na
Katakhali Quick Rental	Northern Power	50	FO	May-11	4,000	5,800	Kathakali	Rajshahi	3,410	2,320	1,090
Santahar 50 MW Peaking Plant	PDB	50	FO	Dec-11	4,000	*6,400*	Santahar	Bogra	na	2,560	na
Chapai Nowabganj (Amnura) QR	Sinha Power	50	FO	May-11	4,000	5,700	Chapai Nowabganj	Chapai Nowabganj	3,420	2,280	1,140
Northwest											
Rangpur	PDB	20	HSD	Operation	2,000	*3,200*	Rangpur	Rangpur	1,050	1,280	-230
Saidpur	PDB	19	HSD	Operation	*2,000*	*3,200*	Saidpur	Dinajpur	1,810	1,280	530
Thakurgaon Rental	RZ Rental	50	HSD	Operation	3,700	7,220	Thakurgaon	Thakurgaon	1,500	2,888	-1,388

2.3.2 Storage Requirements at Depots / Hubs for Power Stations

Under the current, regular structure of M&D operation in Bangladesh (BPC holds the import monopoly of both fuel oil and diesel) the impact of the needs of the power operators on the storage requirements of the M&D companies is thus two-fold:

- The MIs, which handle all liquid fuels whether produced by the refinery or imported, need to cater for the storage and send out requirements of the power operators;
- Conversely, the regional (receiving) depots do not.

Given the high complexity of the M&D logistics in Bangladesh, however, such simply expressed structure is not valid for every situation:

- Power stations supplied by rail: With the exception of two future peaking plants planned in the Southeast area (Dohazari and Hathazari) that will be directly supplied from the MI by rail, all other power stations receive (or will receive) their fuel through a hub. This is for instance the case of those plants located in the western zone (Southwest, West and Northwest areas) supplied by broad gauge railway out of the Daulatpur depot, as is currently the case for Bheramara and Saidpur. Therefore storage capacity at Daulatpur hub needs to be sized for these additional volumes.
- Power stations supplied by river: Most plants are located along a Class I river and are supposed to be accessible in all seasons by coastal tanker, directly from the MIs. Some of them, however, are (or will be) located on the shore of a Class II river, which prevents them from receiving coastal tankers. This is for instance the case of the future Bera and Baghabari peaking plants and the Noapara rental plant, which can only be supplied by shallow draft tankers (SDT). While some SDT have been certified for Bay crossing, which allows them to carry loads directly from the MIs, Bay crossing is subject to climatic conditions and is far from being guaranteed all year long. There again, the concerned hubs (Godnail/Fatullah for Bera/Baghabari; Daulatpur for Noapara) require capacity dedicated to power plants supply.

Table 2.21 presents the storage status and requirements of those oil-run power stations that already operate or are planned to start operation by the end of 2011 (mostly through the Peaking Plants and Quick Rental Programmes).

Tables 2.22 and 2.23 summarize the additional storage requirements for power stations at each hub, as of the end of 2011, for the ADS-15 and ADS-30 options, respectively.

It should be noted that:

- These requirements come on top of the requirements for 'general' consumers presented in Section 2.2 (Table 2.10);
- The requirements will obviously increase as more power stations start functioning from 2012 onwards. As location of these future stations are not known as yet, the needs on year 2020 cannot be estimated at this stage. Therefore, the future requirements need to be consciously monitored as the implementation of new power stations is decided.

Table 2.21 – Storage Requirements at Hubs for Power Stations (2011)

Power Station	Sponsor/ Operator	Capacity (MW)	Fuel Type	Supply Mode		Supply from	Transfer Required at Hub	Hub
Greater Dhaka								
Pagla Quick Rental	DPA Power	50	HSD	River	SDT	MI	Yes, except cross-Bay SDT	GDN/FTL
Ghorashal Quick Rental	Aggreco	45	HSD	River	SDT	MI,GDN	Yes, except cross-Bay SDT	GDN/FTL
Ghorashal Quick Rental	Aggreco	100	HSD	River	SDT	MI,GDN	Yes, except cross-Bay SDT	GDN/FTL
Siddirganj Quick Rental	Desh	100	HSD	River	CT	MI	No	
Madanganj Quick Rental	Summit	102	FO	River	CT	MI	No	
Meghnaghat IEL	IEL	100	FO	River	CT, SDT	MI	No	
Keraniganj Quick Rental	Power Pack Holdings	100	FO	River	CT, SDT	MI	No	
Meghnaghat Quick Rental	Hyperion	100	FO	River	CT, SDT	MI	No	
Siddirganj	Dutch Bangla	100	FO	River	CT	MI	No	
Gazipur Peaking Plant		50	FO	River	SDT	MI,GDN,FTL	Yes, except cross-Bay SDT	GDN/FTL
East Central								
Daudkhandi 50 MW Peaking Plant	PDB	50	FO	River	CT	MI	No	
Southeast								
Shikalbaha	Energis	55	FO	River	CT	MI	No	
Dohazari 100 MW Peaking Plant	PDB	102	FO	Rail	MG	MI	No	
Hathazari 100 MW Peaking Plant	PDB	98	FO	Rail	MG	MI	No	
Julda Quick Rental	Acorn/Bangla Trac	100	FO	River	CT	MI	No	
South								
Barisal	PDB	3	HSD	River	CT	MI	No	
Barisal	PDB	32	HSD	River	CT	MI	No	
Barisal Rental	na	50	FO	River	CT	MI	No	
Southwest								
Khulna (KPS)	PDB	60	FO	River	CT	MI	No	
Khulna (KPS)	PDB	35	FO	River	CT	MI	No	
Bheramara	PDB	54	HSD	Rail	BG	DLP	Yes (CT > BG)	DLP
Bheramara Rental	Quantum Power	110	HSD	Rail	BG	DLP	Yes (CT > BG)	DLP
Khulna Quick Rental	Aggreco	55	HSD	River	CT	MI	No	
Khulna Rental	Aggreco	40	HSD	River	CT	MI	No	
Faridpur 50 MW Peaking Plant	PDB	54	FO	Rail	BG	DLP	Yes (CT > BG)	DLP
Noapara Quick Rental	Quantum Power	105	FO	River	SDT	MI, DLP	Yes, except cross-Bay SDT	DLP
Khulna (KPCL)	KPCL	115	FO	River	CT	MI	No	
Noapara Quick Rental	Khanjahan Ali Power	40	FO	River	SDT	MI, DLP	Yes, except cross-Bay SDT	DLP
Gopalganj 100 MW Peaking Plant	PDB	109	FO	River	SDT	MI	No	
West Central								
Baghabari 50 MW Peaking Plant	PDB	52	FO	River	SDT	MI,GDN,FTL	Yes, except cross-Bay SDT	GDN/FTL
Bera 70 MW Peaking Plant	PDB	71	FO	River	SDT	MI,GDN,FTL	Yes, except cross-Bay SDT	GDN/FTL
West								
Katakhali 50 MW Peaking Plant	PDB	50	FO	Rail	BG	DLP	Yes (CT > BG)	DLP
Katakhali Quick Rental	Northern Power	50	FO	Rail	BG	DLP	Yes (CT > BG)	DLP
Santahar 50 MW Peaking Plant	PDB	50	FO	Rail	BG	DLP	Yes (CT > BG)	DLP
Chapai Nowabganj (Amnura) QR	Sinha Power	50	FO	Rail	BG	DLP	Yes (CT > BG)	DLP
Northwest								
Rangpur	PDB	20	HSD	Rail	MG	MI	No	
						PBT	Yes (CT > BG > MG)	DLP/PBT
Saidpur	PDB	19	HSD	Rail	BG	DLP	Yes (CT > BG)	DLP
Thakurgaon Rental	RZ Rental	50	HSD	Rail	MG	PBT	Yes (CT > BG > MG)	DLP/PBT

Table 2.22 – Storage Requirements at Hubs for Power Stations, ADS-15 (Operating as of end-2011)

Hubs	Diesel	Fuel oil	Total
Godnail / Fatullah	15,080	8,450	23,530
Daulatpur	14,760	18,790	33,550
Parbotipur	4,170		4,170
Total	34,010	27,240	61,250

Table 2.23 – Storage Requirements at Hubs for Power Stations, ADS-30 (Operating as of end-2011)

Hubs	Diesel	Fuel oil	Total
Godnail / Fatullah	30,160	16,900	47,060
Daulatpur	29,520	37,580	67,100
Parbotipur	8,340	0	8,340
Total	68,020	54,480	122,500

3. Water and rail 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, the share of railway for such transfer is about 14%, the rest being carried through waterways.

Products transportation has to face a number of issues that hamper the reliability of the supply from MIs and hubs to the regional depots and has an adverse impact on the security of supply.

3.1 Waterways

3.1.1 Draught Limitation and River Dredging

Out of the 86% petroleum products that are sent out from Chittagong MIs of the 3 marketing companies, the larger portion is carried by coastal tankers. Coastal tankers require a guaranteed draught of 12 feet (3.6 meters) in the river channels and at jetties to be able to carry and unload their full design load, generally around 1,500-1,600 tons of products.

The main problem arises from the progressive siltation of rivers, a regular phenomenon that routinely hampers riverine transportation and gets more acute during the dry winter season. Adverse consequences are two-fold:

- Due to reduced draught, coastal tankers are often not able to carry their full load, in particular during the dry season, i.e. at a time when diesel supply requirements dramatically increase to run irrigation pumps. It is not uncommon for depots to receive coastal tankers with loads as low as 1,000-1,100 tons instead of the full load expected;
- For the same reason tankers may be prevented from travelling on the shortest route and have to take a longer itinerary, which increases both travel time and cost. This is in particular the case with supply to Daulatpur.

Shallow draught tankers (SDT), the smaller version of oil tankers, require about 7 feet draught for carrying a load of about 500 ton. They are used to carry products upstream, such as Baghabari depot from Godnail, Fatullah depots. Recently a few of them, with modern design, have got Bay crossing clearance and so can carry products directly from Chittagong to Baghabari. However, such ability is subject to climatic conditions and cannot be guaranteed all year long.

SDTs face the same situation. Siltation of the Jamuna River and tributaries may routinely prevent SDTs from reaching depots, in particular Baghabari.

The situation is out of the control of the M&D companies, and indeed of the whole petroleum industry. The national authority BIWTA is entrusted by the government with the responsibility of keeping the river routes navigable by dredging of required areas. The main problem is that BIWTA, like many public institutions in Bangladesh, suffers from very limited resources, and is far from being able to operate as there is lack of sufficient number of dredgers in good working condition.

BIWTA has devised a fairly ambitious dredging programme, including (in Phase I) 748 km of rivers along 23 routes to be dredged in order to remove 13 crores (130 million) cubic meters of silt and sediment (see abstracts in Table 3.1). However, BIWTA consider that their current resources do not put them in a position to improve the available draught and that they can hardly maintain draught at the desired level.

While such programme would doubtless require a very long period of time to be implemented – if it can ever be – a timed programme needs to be set up. In order to improve the access to its depots (along with power stations) it is recommended that BPC meet with BIWTA to establish a

joint plan of action, taking into account the interest of the M&D companies and the benefits for the country:

- Identify those key sections of rivers where navigability need to be enhanced as a first priority, for instance to improve access to Daulatpur and Baghabari;
- Estimate the resources required and the cost of mobilising them;
- Highlight the benefit to the country through a cost-benefit analysis. Focus should be applied to the shortest sections that deliver the best overall improvement;
- Establish a timed plan of action with specific targets and resources to meet them.

3.1.2 Tanker Capacity

The design capacity of the coastal tankers is limited: 1,500-1,600 ton in average. That of the SDTs is about one-third (500-600 ton). In addition, many tankers are ageing, as there has been almost no addition to the fleet over the past fifteen years or so. As a consequence, some tankers are out of order, or close to, and their efficiency, in terms of load transported compared to both cost and speed, is low.

Such a situation has not proved unbearable until recently, as the number of tankers available was much larger than the capacity required to transport the products from MIs to the various depots. On the paper, considering the average duration of the voyages and their nominal capacity, tanker capacity was about twice as large as required[7].

However, the rapid expansion of the demand of diesel and fuel oil required by power stations has started to considerably increase the transportation needs and the reliability of the vessels.

The best option to enhance both capacity and reliability is to develop modern tankers with improved design, able to carry bigger loads with same draught limitation. They can also reduce their fuel consumption and the handling loss. International-size Bangladeshi industrial concerns have recently launched new generation ships able to transport containers and bulk goods from Chittagong to inland river ports. These ships are built in local shipyards and their economics have proved satisfactory.

Industry experts think that newly designed coastal tankers could be able to transport well over 2,000 tons while meeting current draught requirements. New hull design would involve increased breadth associated to flat bottom.

Naval architects are ready to work on such new design and produce the blue print of new generation coastal tankers. However, they want to receive expression of interest from concerned parties (BPC, Owners' Association) before they start working on such a large project. It is recommended that BPC meet with the Tanker Owners' Association to address this issue and meet with naval architects / shipyards to launch the study of a new generation tanker.

[7] In fact, the ratio 2 :1 was not that large in reality, due to the poor technical condition of some tankers.

Table 3.1 – BIWTA Dredging Programme (Phase I, abstracts): Selected Routes Relevant for M&D Companies
Sections in red highlight the routes segments where improvement would enhance access to depots and oil-run power stations.

Route	*River(s)*	*Length of Dredging (km)*	*Assessed Dredging volumes (lakh cu.mt.)*	Depots and Power Stations Concerned
Category A (Depth of Water: 5.20 m)				
Dhaka-Munshiganj-Chandpur-Chittagong	Buriganga, Dhaleswari, Meghna, Shahbajpur, Halia Channel, Karnaphuli	20	90	Godnail, Fatullah, Chandpur, several Greater Dhaka PS's, Ashuganj, Bhairab, MIs
Category B (Depth of Water: 4.30 m)				
Bhairab Bazar-Chhatak-Sylhet	Upper Meghna, Baulai, Surma	40	90	Sachna Bazar, (Sylhet)
Chandpur-Char Prakash-Hijla-Barisal	Meghna, Arial Khan, Kirtonkhola	8	18	Barisal and PS's
Chandpur-Muladi-Barisal	Meghna, Arial Khan, Kirtonkhola	5	11	Barisal and PS's
Raimangal-Antihara-Chalna-Mongla-Barisal-Kaliganj-Chandpur-Aricha	Sibsha, Chunkuri, Pussur, Mongla-Ghaslakhali Canal, Gabkhan Canal, Bishkali, Kirthonkhola, Arial Khan, Meghna, Padma	46	104	Daulatpur, Khulna PS's, Barisal, Baghabari, Bera PS (upstream)
Chalna-Khulna-Daulatpur-Noapara	Pussur, Bhairab	22	50	Daulatpur, Khulna PS's, Noapara PS
Category C (Depth of Water: 3.70 m)				
Aricha-Baghabari-Daikhawa	Jamuna, Hurassagor, Baral	56	84	Baghabari, Balashi, Chilmari, Bera PS
Munshiganj-Narayanganj-Demra-Ghorasal-Toke	Silatakhya	64	96	Greater Dhaka PS's, Ghorasal PS
Nandibazar-Madaripur-Gopalganj-Manikdha	Arial Khan, Jayanti, Beel Route, Upper Kumar	30	45	Gopalganj PS
Barisal-Jhalakati-Barguna-Pathargata	Kithonkhola, Bishkali, Khagdaon	22	33	Jhalakati

3.2 Railways

In spite of its smaller share in products transportation (14% vs. 86% for waterways) rail transportation holds an important responsibility in delivering products to numerous depots that cannot be reached by river. Bangladesh Railways (BR) sends out petroleum products from the MIs to different rail head depots in the Northeast (Sylhet, Srimongal, Moglabazar), the Greater Dhaka (EPOL) and East Central (Chandpur, partly) areas, as well as North Bengal (Rangpur, Parbotipur (partly). Most of North Bengal depots, including depots at Natore and Rajsahi, Harian (without storage), are supplied through broad gauge system from Daulatpur. Besides, there are power plants in operation and new more are coming soon, which are and will be supplied with petroleum products through the railway system.

3.2.1 Infrastructures

Shortage of Rolling Stock and Manpower

Rail transport is hampered by a severe shortage of engines, tank wagons and even manpower (drivers), which are currently not able to meet the existing demand, in particular – but not only – during the irrigation season. Improvement of the railway system should be given special priority considering the current needs and the additional load generated by the new power plants that are progressively coming on stream. In addition, BPC / POCL sponsors the project for the supply of jet fuel from the MI directly to the KAD (airport) depot in Dhaka by railway, in order to get rid of the harmful effect of the current transportation system from Godnail depot that uses tank lorries across the already congested Greater Dhaka. Depending on sources the project will require from 100 to 170 new, dedicated tank wagons and 5 to 8 engines, plus drivers.

Tracks

As discussed in the Assessment Report inter-operability between the Eastern Zone (meter gauge) and Western Zone (broad gauge) has dramatically improved since the end of the 1990s since the opening of the Jamuna Bangabhondu Bridge. BR has enhanced flexibility by converting to dual-gauge tracks significant portions of the network, thus enabling the Dhaka area to receive broad gauge trains from Daulatpur and North Bengal to receive trains from Chittagong through meter gauge. This is how the Rangpur depot is now able to receive seamless trains from MIs.

Further improvements are required.

The most urgent project would be to complete the implementation of double track over the (meter gauge) Chittagong-Tongi route. The line is heavily congested and some sections are already saturated. Double track would not only dramatically increase the overall transit capacity of the line, but it also would reduce travel time, thus enhancing the efficiency of engines and wagons. The project funded with the assistance of the ADB is reportedly on halt due the difficulty for the Government to meet the conditions associated to the loan. The project of supplying the KAD depot by rail from MI, which will typically require two daily rack trains, could be severely constrained by the lack of slots currently available along the route.

Develop dual tracks: The Rangpur depot, in spite of its limited size, is currently utilised well below its nominal capacity:

- The line between Rangpur and the Parbotipur railway junction, where an important depot is installed, belongs to the meter gauge system. The only possible seamless connection consists of direct trains from the MIs. However, the Rangpur depot receives only three trains per month in average, due to the above-mentioned lack of rolling stock, and also because of the technical condition of the Jamuna Bridge, where structural weaknesses (cracks) limit the

daily transit to 11 trains. Until the bridge is fixed it is highly unlikely that the number of trains to Rangpur may increase.

- Rangpur may also be supplied from Daulatpur, which requires transferring at Parbotipur the products from broad gauge to meter gauge wagons, and storing momentarily the products at the Parbotipur depot prior to being loaded again in meter gauge tankers. Such operation requires time, room at the Parbotipur depot, and availability of meter gauge engines and wagons at the right time. We support the request of the M&D companies to have BR install dual gauge track on the 40-km long, meter gauge Parbotipur-Rangpur section, which would enable the Rangpur depot to receive direct broad gauge trains from Daulatpur.

3.2.2 Need for Enhanced Cooperation

There seems to be a general lack of cooperation between BPC and the M&D companies on one hand, and Bangladesh Railways on the other hand, with regards to both equipment (e.g. rolling stock requirements) and day-to-day operation. For instance, M&D operators at MIs or Daulatpur dispatch installations in charge of preparing tank wagons to be sent out to regional depots cannot request a specific date for the trains to be received at the depot. Actually trains are assembled when engines and drivers are available at BR yardmaster's facilities. There are no programmed travel schedules, causing depots to be supplied on a very irregular basis. Similarly, M&D dispatch officers are not kept informed by BR of the scheduled and actual dates of departure from BR yard and arrival of the rack trains at depots, which makes it very uneasy for depot managers to organise the reception of the products and their distribution to agents and dealers.

Greater cooperation between M&D companies and BR is required at all levels. It needs to be established where it is missing, and deepened where it already exists but is not satisfactorily exercised. Mutually agreed procedures should be developed in the fields of:

Long term planning. There is no such long term planning for the time being. Indeed, long term requirements are regularly established by both demand (e.g. BPC and the M&D companies) and supply operators (e.g. BR, BIWTA) for their own purpose, but operators have not become accustomed to sit together frequently and confront their views, needs and resources. Also, the lack of own financial resources that would enable the operators to decide and finance their investments does not help develop such long term planning. BPC and M&D companies should devise a long term **Petroleum Products Marketing & Distribution Master Plan**, involving transportation operators in order to identify and determine the needs of Bangladesh in terms of volumes of products to be transported; transport routes; storage requirements; frequency of trains and tankers; schedules; duration of journeys. Energy audits presented in the Policy Recommendations report are fully part of the Master Plan.

Once under implementation, the Master Plan should be maintained and adjusted, if need be, to take into account the evolution of the demand (e.g. in terms of volumes and location) and the possible technological improvements of the transportation system. Periodical meetings (e.g. every two years) should take place with all parties involved to proceed with such evolution.

Medium term operation. Transports needs are currently presented and discussed / decided during large size meetings attended by all operators (BPC, BR, BIWTA, etc.) that take place at ministry every year in November. In the mean time there is little flexibility to modify the decisions taken. We propose that transport requirements be discussed and determined on a regular, more frequent basis (e.g. quarterly), and at a lower level to allow for added reactivity in case of changes in the demand or supply patterns.

Short term operation: Information concerning the availability of wagons and engines and the consequences on the size and schedule of rack trains should be transmitted by BR yardmasters to M&D dispatch facilities in real time, in order to enable M&D companies to handle storage facilities as efficiently as possible.

4. Oil products pipeline

4.1 Project Objective and Description

As presented in Section 2.1 above, Bangladesh is expected to face a dramatic development of the oil demand, in particular for diesel. Demand should be multiplied by 2 in 2016 (from 2010 consumption), 2.5 in 2020 and 4.5 in 2030. As a consequence, transport (and storage) requirements will increase in about the same proportion. Considering the current weaknesses of the transportation system, whether by river or rail, a products pipeline would offer a much suitable alternative to coastal tankers and rail tankers on the trunk route from MIs to the Dhaka and West Central areas. This would also reduce the number of tankers that would be required to transport the oil and reduce the congestion at the Chittagong Port.

In order to assess both the technical and economic feasibility of such project, we have conducted a preliminary analysis of a multi-products pipeline along the following lines:

Route:

- The pipeline originates at the site of the future refinery on the mainland, near Kutubdia Island (for this reason, we may refer in the report to either the "future refinery" or the "Kutubdia Refinery", although the site is on the mainland), and ends at the Baghabari depot;
- It is routed through the ERL refinery in order to either unload products at ERL / MIs coming from the future refinery, or load products produced at ERL or stored at the MIs, depending on the scenario that will eventually be selected by Bangladesh authorities;
- The main offtake is at Godnail depot; however, we recommend that a new, larger storage site be constructed around Dhaka (see Section 3.5 below) to complement storage capacity at Godnail and Fatullah;
- The final offtake is at Baghabari in the West Central area.

Capacity:

- The pipeline is designed to meet demand requirements in Central and Western Bangladesh at least up to 2030, without any additional equipment. It is designed to transport 6.5 million tons annually from the future refinery to Godnail, and 2 million tons from Godnail to Baghabari;

Catchment area:

- From Godnail (and a future depot in the area): the Greater Dhaka area; 50% of the East Central area; and 10% of the Northeast area;
- From Baghabari: the whole of North Bengal, i.e. the West Central, Northwest and West areas. While supplying the West Central area does not require the construction of additional infrastructure (except increased storage capacity at Baghabari) the Northwest and West areas will not be supplied through Daulatpur any longer. The main advantage is to limit the transport and storage infrastructure to and at Daulatpur to the requirements of the sole Southwest area. However, a dedicated railway branch line will be required from the Ishurdi-Jamuna Bridge rail track to Baghabari – an option that is already under consideration at BPC. An alternative option would be to locate the final offtake of the pipeline and to build the new depot close to the railway line.

Products:

- The pipeline will transport all main products, except heavy fuel oil that cannot be moved by pipeline due to higher viscosity, and LPG;

- The products transported are: regular (MS) and premium (HOBC) gasoline, kerosene (SKO), jet fuel, and diesel (HSD);
- Fuel oil and LPG will keep on being transported by coastal tanker / SDT or rail / tank lorries.

4.2 Physical and Design Flow Rates

Table 4.1 presents the design flow rates, based on the volumes of each product to be transported. Load factor is 0.95.

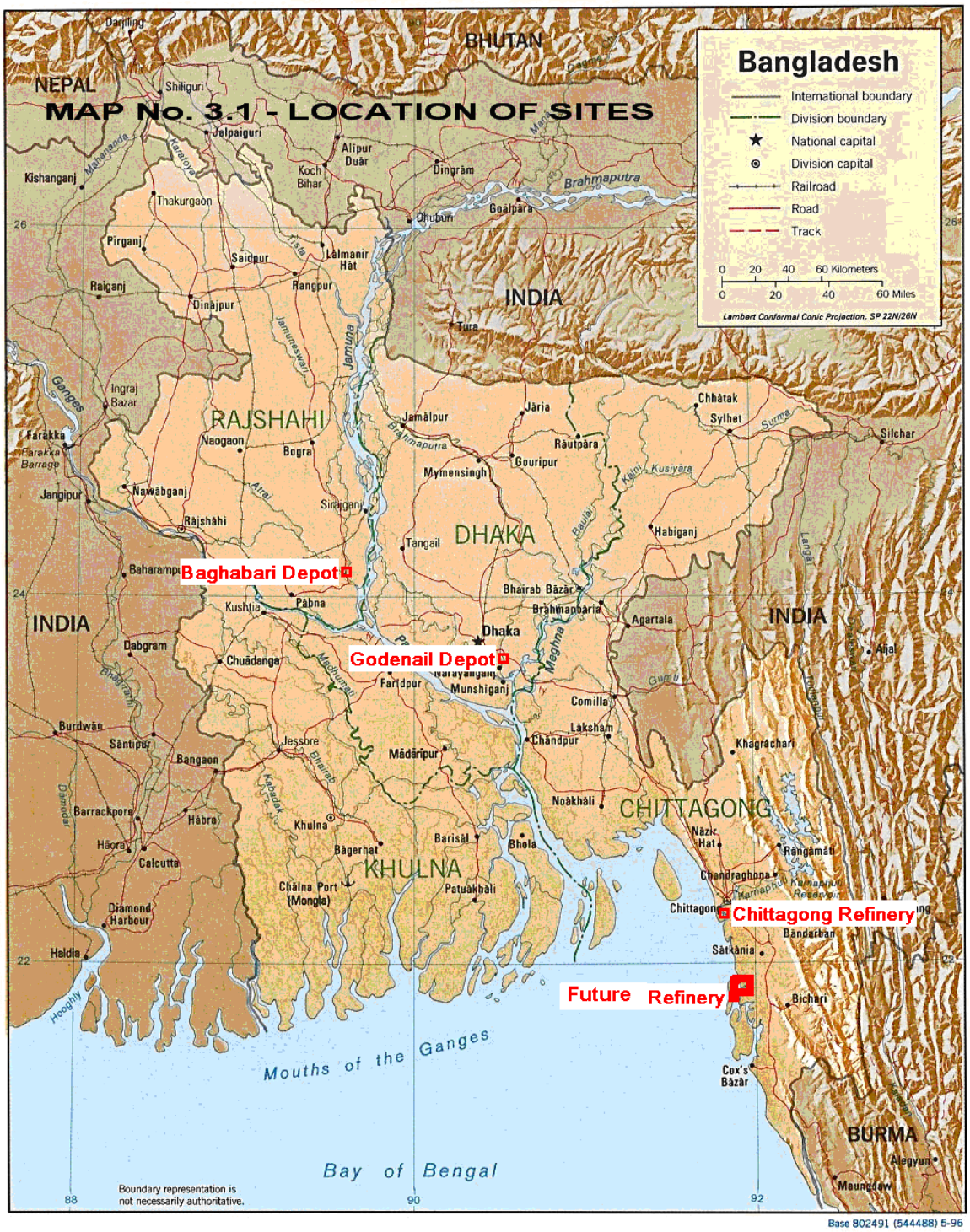
Table 4.1 – Flow Rates from the future refinery to Godnail, and Godnail to Baghabari

Products	*Refinery to Godnail*		Godnail to Baghabari	
	Yearly Flow Rate (ton/year)	Design Flow Rate (m3/hour)	Yearly Flow Rate (ton/year)	Design Flow Rate (m3/hour)
Diesel	5,300,000	764	1,630,000	235
Jet fuel	450,000	67	140,000	21
Kerosene	375,000	57	115,000	17
Gasoline	375,000	60	115,000	18
Total	**6,500,000**	**948**	**2,000,000**	**291**

From the future refinery to Godnail section of the pipeline, options with three alternative diameters have been studied and assessed: 18-inch, 20-inch and 22-inch, along with associated pumping capacity. Preliminary optimisation exercise shows that the **18-inch option** is the most economic.

From Godnail to Baghabari the **12-inch option** shows the best economics.

Map 4.2 – Location of Pipeline Intakes and Offtakes



4.3 Pipeline Route

4.3.1 From The Future Refinery to Chittagong (ERL)

The starting point of the pipeline route is at the proposed site location for the future refinery, about 60km south of Chittagong. From that point, the route follows a South-North direction up to the southern part of the Chittagong conurbation, where it turns west towards the ERL Refinery, which is reached after crossing the Karnaphuli River (600 m wide at this location).

Except for the major crossings indicated above, the layout is generally quite flat and presents no major problems apart from crossing some urban and suburban areas, rivers and canals of limited importance.

The length of this first section is 66 km.

4.3.2 From Chittagong (ERL) to Godnail

The starting point of the route is the Chittagong (ERL) refinery. From that point, the route heads westward to reach the coastline where it turns to the north. It then runs along existing roads before curving eastward to avoid northern Chittagong urbanised areas. Then the route diverts to the north and generally follows the railway track to Dhaka, on the edge of wooded areas of moderate but undeveloped relief. At KP 85, the route bends westward on 20 km, then runs back northward at the foot of landforms along road N1. At KP 135, the route follows a north-north-west direction in parallel to roads N1 and N102 and west after KP 196 through areas becoming more urbanised. At KP 218, the route crosses a 1500 m wide river. After a final change of direction at KP 230, the route reaches at KP 246 the Godnail depot after crossing the river.

After KP 85, the layout is generally quite flat and presents no major problems apart from crossing some urban and suburban areas, ponds, rivers and canals of limited importance with the exception of the river crossed at KP 196.

The length of the second section is 246 km.

4.3.3 From Godnail to Baghabari

The starting point of the route is the Godnail depot. From that point until KP 61, the route heads towards the north through areas highly urbanised and requiring the crossing of major roads. Crossing urbanised areas will require specific studies conducted at the feasibility and conceptual stage of the project.

After KP 61, the route curves westwards to KP 119 and does not meet major problems except the crossing of the Jamuna River between KP 110 and KP 119. The crossing construction procedure shall be investigated on the basis of information not available at present (crossing profiles, stability of rivers bottom and edges, geo-mechanical properties of soil, etc.).

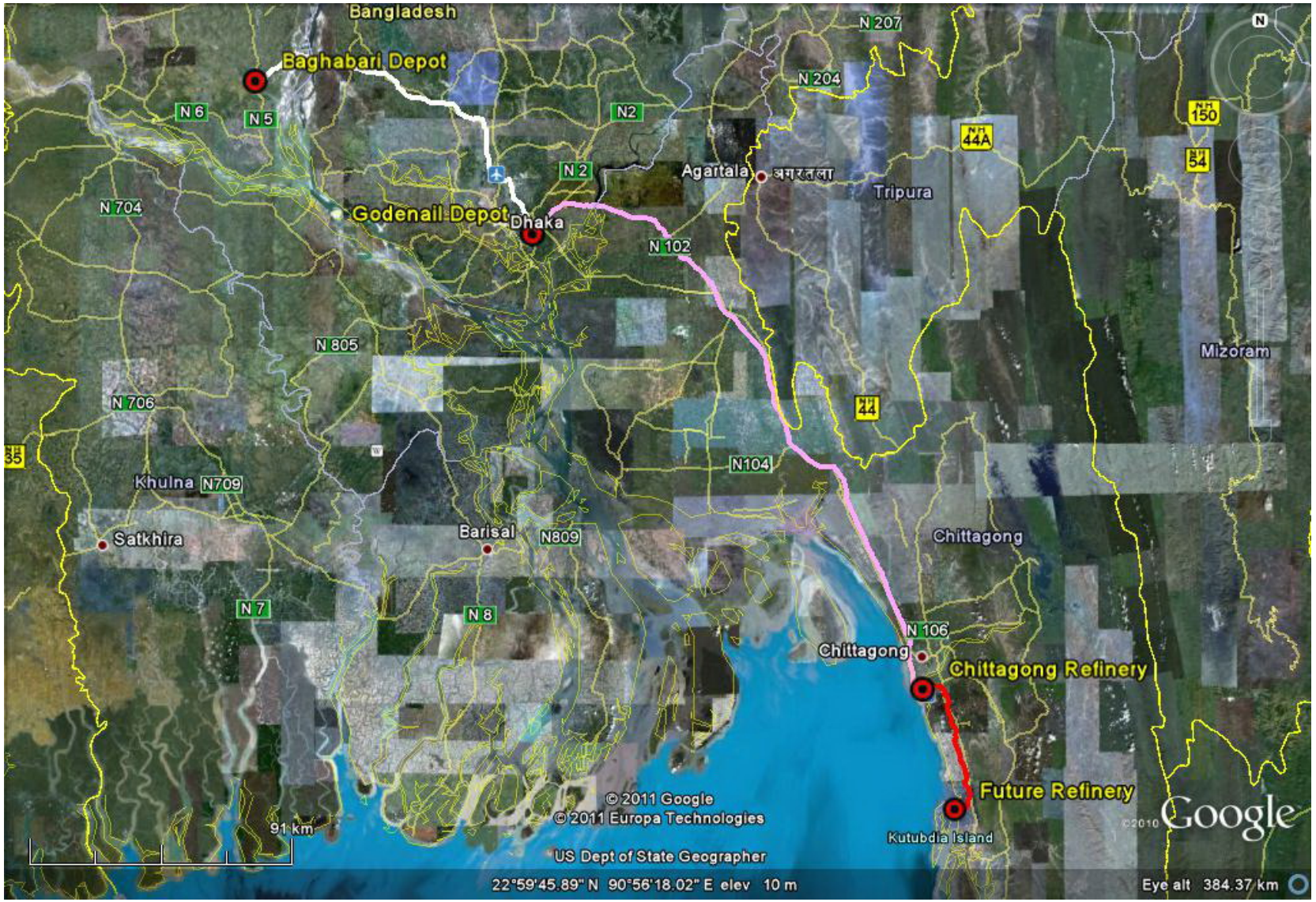
After PK 119, the route heads southwest in direction of Baghabari terminal through flood plains and relatively wide rivers (100 to 200 m).

The length of the final section is 136 km.

Table 4.3 – Segment-wise Lengths from the Future Refinery to Baghabari

Departure	Arrival	Length (km)
Future-Refinery	Chittagong Refinery	66
Chittagong Refinery	Godenail Depot	246
Godenail Depot	Baghabari Depot	136
Total Length		**448**

Map 4.4 - Pipeline Route



4.4 Batching Design

4.4.1 General

Products of the same quality will be shipped in sequence through the pipeline, with each product or batch distinct from the preceding or following.

Batch means therefore a specific quantity and type of product pumped into the pipeline.

Batch change corresponds to the transition from one product to another into the pipeline as evidenced by a change in product colour or gravity or both.

Batching is the method for dealing with the different products and product specifications moving through the pipeline. Batching determines consequently the sequence in which two or more products are to be pumped and introduced into the pipeline in a **sequence** that results in the least formation of interfacial material or minimising as much as it is possible the need to reprocess the mixed interface, taking into account the admitted levels of contamination of products.

Minimum batch size is based on a number of operating factors such as pipeline size, flow rate, tankage availability, admitted level of contamination, demand, etc.

Cycle is the period of time from pumping a certain grade until other grades are pumped, and the initial grade is pumped again beginning the new cycle.

Mixing corresponds to the amount of intermixing between the first product and the following one at the **interface**, the point where they meet:

- If the products are similar (e.g. two grades of gasoline), the resulting mixture is added to the lower value product taking into account the admitted level of contamination;
- If the products are dissimilar (e.g. diesel and gasoline), the transmix, i.e. the hybrid product created by intermixing at the interface, must be channelled to separate storage and reprocessed.

4.4.2 Minimum Batch Size

Minimum batch size can be determined from knowledge of the allowable contamination of one product in another. However such a degradation allowance depends on legal requirements rather than practical necessity.

From a legal point of view, a product (e.g., unleaded gasoline) has to be delivered to the market with contaminants not exceeding government-specified component limits. Contamination levels in batch product pipelines are related to the size and type of batches or tenders required for entrance into the pipeline.

Likewise, it is essential to prevent aviation fuels (e.g. jet fuel) from being contaminated with other petroleum products between the time it is manufactured in the refinery until the moment it is put onboard an aircraft. Consequently fixed storage facilities are designed to keep aviation fuel physically isolated from other products. Multiproduct pipelines can carry compatible products, both preceding and following jet fuel; the interface product is then cut into non-aviation grade. Samples are taken for recertification testing in which those properties most sensitive to contamination e.g.: flash point, freezing point, gum, etc; are retested and the result compared with the original values reported on the refinery certificate of quality to confirm no inter-product contamination has occurred.

Typical allowable contamination levels accepted by the industry are shown in table No. 4.5.

Table 4.5 – Industry Accepted Contamination Level in Products

Contaminant	Product	Accepted Contamination Level %
Jet Fuel or Kerosene	Gasoline	1
Jet Fuel or Kerosene	Diesel (GO)	2
Any	Jet Fuel or Kerosene	Nil

4.4.3 Interface Volume Prediction

The volume of interfaces depends on differences in gravity and viscosity of adjacent products and on pressure and velocity of the stream.

It also depends on the inside condition of the pipeline, the number of pump stations and on the distance travelled by the interface.

Interface size can be reduced by:

- Maintaining a pumping rate needed to keep the heaviest product in the line in turbulent flow;
- Putting products in the line in proper batching sequence;
- Keeping the line pressurised during a shutdown.

These recommendations shall be addressed at the conceptual stage of the pipeline design.

4.4.4 Batching Sequence

Diesel accounts for about 80% of the total volume; others products represent only 5.5% to 7% each.

In the typical batching sequence presented in Figure 3.6 below, the products are pumped in the following order:

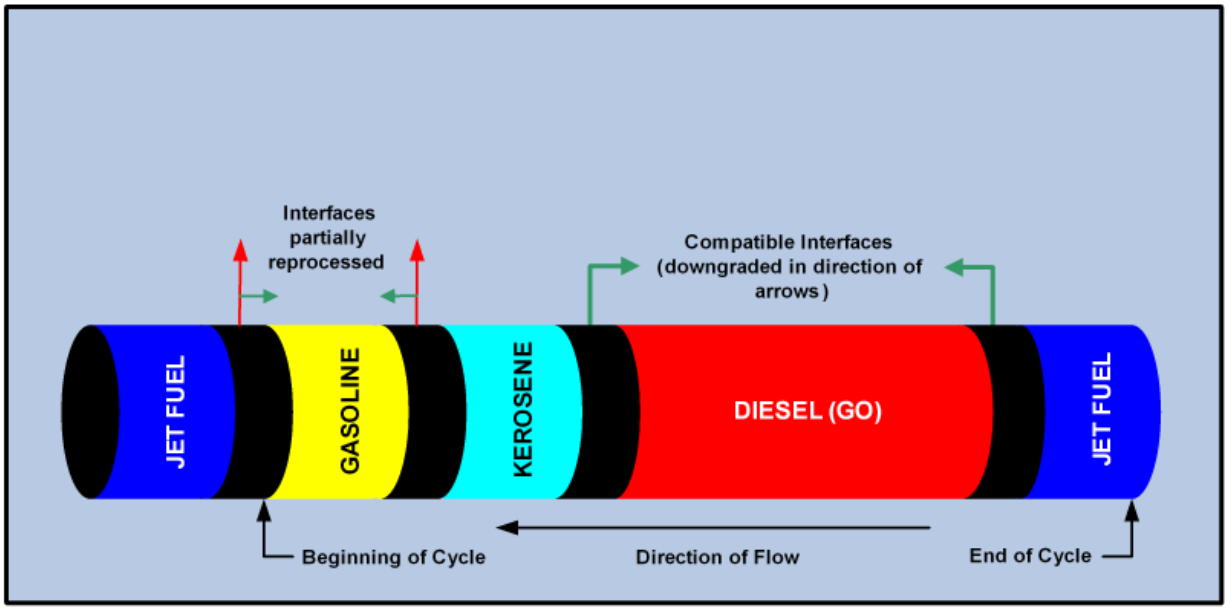
1) Gasoline

2) Kerosene

3) Diesel

4) Jet Fuel.

Figure 4.6 – Batching Sequence



4.4.5 Process Outline

The sequential transportation of liquids in a batch form is commonly used to transport multitudes of products through a single pipeline. This form of transportation includes batch transportation of low as well of high-vapour pressure fluids.

The process is generally similar to the transport of a single liquid product by a dedicated pipeline, with the following main differences:

- A mixing interface between the adjacent products develops within the pipeline during the transport of products and requires specific delivery procedures to meet the product specifications at terminal locations;
- Deliveries to storage or to branch pipelines at intermediate points, if any, of the pipeline shall made from heart cuts, i.e.: portions of pure product taken from the main line before or after the mixed interface;
- Pumps must be suitable for various liquids with densities and viscosities substantially different leading to variable pipeline hydraulic gradients and consequently to changes in hydraulic pump heads.

In order to control product flow through the pipeline, it must be determined where one batch ends and another batch begins. There are several methods:

- Gravity difference: batch changes may be detected by differences in gravity of two adjacent products;
- Colour change: batch may be detected by differences in colour of two adjacent products;
- Dye plugs: a plug of dye can be injected into a line to separate products belonging to different customers. It is also used to separate similar products with little or no colour differences;
- Liquid buffers: kerosene or some neutral product (in a small amount) may be used as a liquid buffer to separate incompatible products. Water should not be used;

- Physical buffers: a physical buffer is an object such as a pig, rubber ball or scraper placed in the line to separate batches and cut down on the interface. Batching in the early days was achieved by injecting a product into the pipeline followed by a separation pig (usually a sphere) and then the second batch of another product/ fluid. Batching a multitude of products without a separation pig is more common now-a-days.

Product specifications are verified before the product is introduced into the pipeline.

At their destination, when the products leave the pipeline, they are tested again to ensure that the product quality has been maintained during its transmission from the refinery to the depot. Depending on the level of automation of the delivery facilities, either operators on site or control room operators position valves to direct the products to the correct tanks.

When the mixed interface cannot be added into any of the adjacent product, the contaminated part is directed to a transmix tank. From there, it is transported by truck or rail to a re-processor.

Because of the complexity of multi-product pipeline operations, it is recommended to provide a resolutely modern SCADA and telecommunications system allowing the remote control of all pipeline system operations (control of product quality, pumping stations operations, contaminated interface tracking, interface processing to the delivery terminal, storage of products, etc.). Such a system has been incorporated into the pipeline system cost estimate.

4.5 Storage Capacity at Pipeline Offtake

4.5.1 Storage Requirements

At the outlet of the pipeline, the products are stored in above ground fabricated storage tanks in depots before being transferred onto road tankers to customers and filling stations.

Depots shall have therefore a sufficient capacity to store the market demand of their products.

The storage capacity can be determined from the following basic formula:

$V_T = ADD*T_d + ST + V_b + SFA$

Where:

- V_T = Optimum size of the storage (m^3)
- ADD = Average Daily Demand (m^3)
- T_d = Cycle time between batches of the particular product (days)
- ST = Safety Stock, i.e.: the extra product kept on hand to avoid running out between deliveries and running over during delivery (m^3)
- V_b = Volume of tank in the bottom where product is inaccessible (m^3)(deadweight)
- SFA = Safe Fill Allowance i.e.: the safety factor allowed keeping from overfilling (m^3).

In fact, the Average Daily Demand (ADD) in m^3/day multiplied by the cycle time (T_d) in days represents the volume of a particular product transported during the cycle duration, i.e.: the batching volume of the product.

The Safety Stock has been assumed to 14 days of the average daily demand.

The volume of bottom tanks and the Safety Fill Allowance corresponds respectively to 8% and 12% of the total volume which shall be stored (i.e.: the addition of batching and Safety Stock volumes).

Based on previous assumptions, the calculations of the storage capacity required at Godnail have been performed.

A summary of the storage capacity required at Dhaka Offtake for each product, according to the proposed batching cycle scenarios, is given in Table 4.7.

Table 4.7 – Storage Capacity Required at Dhaka Offtake Storage

PARAMETERS		UNIT	DATA
PIPELINE DATA	External Diameter	inch	18
	Pipeline Volume	m^3	47,053
Number of times that the pipeline capacity has been used during the cycle: 3			
REQUIRED STORAGE CAPACITY	Gasoline	m^3	32,666
	Kerosene	m^3	30,542
	Diesel	m^3	444,178
	Jet Fuel	m^3	38,880
Number of times that the pipeline capacity has been used during the cycle: 4			
REQUIRED STORAGE CAPACITY	Gasoline	m^3	36,003
	Kerosene	m^3	33,663
	Diesel	m^3	489,553
	Jet Fuel	m^3	42,852
Number of times that the pipeline capacity has been used during the cycle: 5			
REQUIRED STORAGE CAPACITY	Gasoline	m^3	39,995
	Kerosene	m^3	37,396
	Diesel	m^3	543,843
	Jet Fuel	m^3	47,604

4.5.2 New Storage Site

The current storage sites of the Greater Dhaka area (Godnail and Fatullah) are unlikely to offer enough land area to implement the vast depot that will be required once the pipeline is running at full load. The location of a new site should be assessed in the medium term. There is no urgency, as the pipeline, when put in operation by the middle of this decade, will be used at about half load, progressively increasing towards full load by the turn of the 2030s. However, should the decision to build the pipeline be taken, it would be wiser to select and undertake the construction of the new site as early as possible rather than develop additional capacity at Godnail, which will become obsolete as soon as the new depot is put in operation.

In our mind, the best option would be to look for a site in the northern part of the Dhaka area, somewhere around the Tongi railway junction, which should include a dedicated double gauge siding (as is the case at Parbotipur depot). Several other areas may be investigated, e.g. in the south or the southeast of Dhaka, in particular to take into account the presence of a waterway that would allow for dual-mode supply.

The Tongi area offers a four-fold advantage:

- Easy connection by rail to north-eastern Bangladesh, which would allow to supplement the supply to the Northeast area depots in the event of the meter gauge system not being upgraded to full double track between Chittagong and Bhairab Junction;
- Easy connection by rail to North Bengal, should the Dhaka-Baghabari section of the pipeline not be built – or at a later stage;
- Easier supply of the KAD depot, which could be connected to the pipeline by a dedicated branch line, should the rail supply scheme not be implemented, or prove to be insufficient;
- Easier access to the north and the west of the Dhaka Division (Mynmensingh), as tank lorries would not have to cross the conurbation from the already heavily congested Narayanganj area.

4.6 Economic Analysis

4.6.1 Capex

The investments have been established in USD and based on prices in the first quarter of 2011 and for supply, construction and commissioning of the pipeline system as described in the previous section No.4.5

Line pipe supply has been assumed from Asia (Japan).

Contingencies have been fixed to 10% of the investments.

At this stage of project definition, the cost accuracy is of the order of +/- 35%.

The total capex of the 18-inch pipeline variant, including stations, engineering and supervision, and 10% contingencies, is estimated at 292 millions USD, i.e. 935 USD/meter and 52 USD/inch*metre.

4.6.2 Opex

Yearly fixed operating costs have been fixed to 1% and 3% for respectively the pipeline and the pumping stations.

The variable operating costs mainly consist of the cost of energy used for pumping and are proportional to the actual load factor of the pipeline. We consider that pumping stations will be fuelled by autonomous generation units owned and operated by the pipeline operator, in order not to depend on unreliable power supply from the grid. A unit cost of 0.20 USD/kWh (based on the 14 Tk/kWh charged by sponsors of the Quick Rental Programme) has been used to calculate the energy cost of pumping stations.

OPEX amount to 2.8 million USD per year (fixed cost) and 8.7 million USD per year (variable cost at full load).

4.6.3 Transportation Cost

Techno-economic parameters considered:

- Discount rate: 12%;
- Economic lifetime of the project: 20 years of operation plus construction time;
- Construction time: 3 years, with a 15%-35%-50% breakdown from Year -3 through Year -1.

The pipeline is considered to be built from 2013 through 2015.

First year of operation: 2016; 20th year: 2035.

The pipeline throughput is based on the demand projections in the given years of operation until the maximum pipeline capacity is reached; beyond that date it is equivalent to that maximum capacity. The full capacity of the pipeline (6.5 and 2 million tons per year (tpy) for the new refinery-Godnail and Godnail-Baghabari sections respectively) is reached in 2033 and 2032 respectively.

The cost of transportation is the following:

- From the new refinery to Godnail: 11.8 USD/ton
- From Godnail to Baghabari: 11.2 USD/ton

The transportation cost may seem high, when compared with the usual pipeline costs observed throughout the world. For instance in Europe, typical large-diameter pipeline costs usually range between 1.8 and 2.5 Euros (2.5 and 3.5 USD) per ton per 100 km, which leads to a cost of around 7.5 and 10 USD per ton for the main section (Future refinery to Godnail). The reason is three-fold:

- The construction time spreads over three years, to take into account the fact that weather conditions prevent from working during a full year;
- While the terrain itself is not difficult, there is an above-average number of special points (rivers, marshes, etc.) along the pipeline route;
- The pipeline is not used at full capacity from start-up. As mentioned above, the build-up period (the time period required before the pipeline is used at full capacity) follows the demand increase and lasts over several years.

Prices are based on international, well-admitted standard costs for steel, equipment and civil works. Using low-cost contractors (e.g. from Bangladesh, China) may substantially reduce the cost of construction, in particular civil works. However, engineering standards request that, at such a preliminary cost estimate stage where the origin of the suppliers is unknown, international standards be used to estimate the cost of the project. When the real feasibility phase is reached, specific instructions may be given by the sponsor to consider a specific origin of providers and equipment vendors.

5. Products prices

Setting the prices of oil products is indeed at the interface between policy and technical matters. It belongs to policy because the design of price setting is a sovereign decision and is as such under the responsibility of policy makers, both government and law makers. But it also includes a strong technical and economic content, as a price setting policy can only be sustainable when it is based on real economic grounds and costs.

For this reason this chapter includes some sections that are also to be found in the Policy recommendations report inasmuch as they deal with marketing and distribution matters.

5.1 Proposed Policy and Price Structure

End user prices are composed of a number of price elements and these can be divided into international and domestic elements, to which taxes and duties are applied. The international element, or Basic Fuel Price (BFP), is based on what it would cost a Bangladeshi importer to buy a product from an international refinery and to transport this product onto Chittagong.

A typical price structure thus includes three key components:

- International price component
- Domestic component
- Taxes

5.1.1 International Market Prices[8]

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 / BSTI specifications on a sustainable basis.

The domestic prices for refined products should reflect the international market prices. Part of the recommended methodology is the assessment of market parity prices (as we recommend on basis of international acceptable price reports such as Platts and Argus). Throughout the study prices have been based on Platt's Singapore FOB for all products, with a motivation discussed in the Refining Assessment report. 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 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 Platt's prices for their sales to foreign off takers.

5.1.2 Domestic Component

To arrive at the final retail or warehouse price (for heavy fuel oils) in the country certain domestic cost elements such as transport costs and sufficient retail and wholesale margins need to be added to the international price.

[8] This component is described in more detail in the Policy Recommendations report.

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 (currently Chittagong) to the inland depot serving the area or zone.

From a pure economic standpoint transport prices to the different pricing zones are determined by using the most economical mode(s) of transport i.e. river barges, pipeline or rail. In Bangladesh, M&D operators are routinely facing logistics problems that may hamper the timely and appropriate delivery of the products required at depots. Security of supply is a key issue that may lead to require more reliable means of transportation (e.g. products pipeline), even if it is not the cheapest one. The cost differential between the costlier, state-of-the-art transport means and the cheaper, less reliable means constitutes the cost of the security of supply or risk mitigation.

There are two ways of setting transportation prices. The first concept considers that consumers have to pay the real cost of the service; they are charged the exact value of the service, i.e. consumers located farther are charged a higher price. A variant consists in creating several delivery areas, used as pricing zones, where the transport price is the same across a given area, whatever the location of the consumer within this area, in order to make price structure simpler to administer.

The second concept is the 'postage stamp' system, whereby all consumers across the country pay the same price, in order not to penalise consumers located in remote areas. It is a political decision based on the government's country planning policy. Total real costs (charged by transport operators) are divided among all tonnes transported and this single, common price is charged to every consumer. Bangladesh has opted for the latter concept. It implies that an equalization fund be put in place (which is the case in Bangladesh), and carefully monitored, to make sure that the receipts fuelled by the fund are permanently sufficient to make payments to transport operators.

Wholesale (Marketing) margin

This element compensates marketers for actual depot related costs (storage and handling). It is the money paid to the M&D companies through whose branded pump or depot tank the product is sold, to compensate for marketing activities. The margin thus includes:

- Handling oil products at MIs (unloading import ships or reception from the refinery);
- Primary storage at MIs;
- Send out / dispatch oil products by rail, water or tank lorries to regional depots;
- Secondary storage at regional depots;
- Commercial (sales) and administrative tasks: sales and handling records, billing and collecting, customer service (for direct customers), organisation of bulk transport, payment to transport operators and retailers.

M&D companies are primarily wholesalers. Their responsibility ends at the gate of the depot. They are, in particular, not in charge of supplying end users (it is the role of retailers), including larger, direct consumers such as power stations, although the contract signed between PDB and Quick Rental sponsors state that BPC is responsible for delivering the fuel required at the gate of the power station.

The wholesale margin is currently controlled by the government. It should be allowing for sufficient compensation based on the oil companies' necessary return on their marketing assets.

Retail margin

The retail margin is the amount of money paid to the retailers: dealers (filling stations), agents and packed point dealers (PPD). Their activities include:

- Loading oil products at regional depots and transport them to selling points. They own and operate, or contract out, tanker lorries;

- Building and operating selling outlets, including filling stations (dealers);
- Supplying sub-agents (agents).

There again the retail margin is currently controlled by the government and included in the price list.

5.1.3 Review price structure and levels

All price components (refinery / import price, transfer / wholesale prices and end user / retail prices) are currently established and fixed by the government. All domestic elements are included in a price structure or price list that is amended whenever the government considers they have to do so. While prices presumably reflected, in the beginning, the real economic cost of each component, they have since evolved following political and social objectives rather than economic considerations and do not carry any more a much needed relationship to the real variations of the costs components.

We recommend that the concept and levels of oil prices be completely overhauled in order to set a clear and sustainable link to the real economic patterns of the industry.

The determination of the technical costs (transport, wholesale, retail) should be based on the results of an independent cost/financial investigation by an energy audit carried out by a government appointed accounting firm. Margins should then be established along the main principles briefly described below:

Wholesale (M&D companies). The level of the margin is calculated on an industry basis and is aimed at granting marketers a return of, say, 15% on depreciated book values of assets, with allowance for additional depreciation, but before tax and payment of interest. It is definitely necessary that the cost base used to set the margin does include assets depreciation, in order for the operators to generate the money requested to invest and develop their activities. The industry should be allowed by the government to operate autonomously and shift from the current fund allocation system whereby every project (beyond a given, low amount) has to be funded from the State budget (whatever the origin of the funds).

Retail margin and *transport cost*. It should be determined on the basis of actual costs incurred by the dealer or agent in distributing the product, or by the transport operators. In determining the real costs account is taken of all proportionate and directly retail related or transport costs such as (not limited to) investment, interest, labour, overheads, working capital and profit. The way in which the margin is determined creates an incentive to dealers and transport operators to strive towards greater efficiency, to beat the average and to realise a net profit proportionate to their efficiency.

5.1.4 Taxes

Taxes are applied in almost all countries for a variety of reasons. Primary objective is to provide fresh money for the National Exchequer. It is also used 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 of the taxes and its transfer to the Treasury.

Taxes will also provide State revenue for example to finance major projects in 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 on just the transportation fuel provides 510 million USD/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).

Two types of taxes should be considered in Bangladesh:

Fuel tax

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

Customs & Excise levy, Local tax

A tax levied by the government on imported oil and taxes imposed by the local authorities to fund road building and or other infrastructure.

5.2 Removing Subsidies

Subsidies are in most countries only limited to target groups use, such as e.g. agriculture, priority development projects or public transport. The situation is different in the case of Bangladesh, where all products are receiving a subsidy[9] (through a price setting well below the market parity price). The problem is that 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 are, 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 as to who needs to be subsidised, as long as it is used with care and within an overall policy structure.

5.3 Price Control

Current Bangladesh policies for oil and gas products are based on government-enforced price controls.

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

[9] Usually except gasoline.

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.

5.4 Price Setting and Regulation

Because of the different nature of the three key price components mentioned above, their setting and regulation cannot be in a single hand.

5.4.1 International Component (BFP)

As the BFP (Basic Fuel Price) is used by the government as the transfer price between refining and marketing in the price build-up for product 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.

Essentially, prices are driven by supply and demand for petrol in a particular market. Additionally crude oil prices have a major effect on the petroleum product 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 product 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.

Because no Authority in Bangladesh has any bearing over the real value of the international price component, it should be considered as a 'given' and precisely reflect the variations of the landed price of oil products in Bangladesh. Its real value should be incorporated into the final (retail or bulk) price without any modification, in a perfectly transparent manner, under the 'pass through'

principle. The pricing mechanism should be transparent, 'automatic', and immediately enforceable, leaving no leeway whatsoever to discussing or amending for any reason the true value of oil.

To avoid possible interference of the political power the regulation of oil prices should be under the responsibility of an independent body. Bangladesh Energy Regulatory Commission (BERC) could be entrusted with the design of the periodic revision formulae (e.g. every month) and the subsequent computation of the next-month landed price.

However, the complex procedures currently used by BERC to set gas and power prices, including a lengthy hearing process, are definitely not applicable to international oil pricing. They should just be discarded and replaced by an efficient ad hoc, grassroots system to be designed. The periodically revised international prices should be based on the figures published by independent, widely acknowledged sources, such as e.g. Platt's, using FOB figures for the geographical locations where Bangladesh is mainly supplied from, e.g. Arabian Gulf for liquid products and Singapore for LPG.

5.4.2 Domestic Component

It is the usual role of the regulatory authority to determine, set and control the energy tariffs and end user prices whenever an energy industry is a natural monopoly, as are the gas and power industries. The oil products industry is often considered an open market, competitive activity because several operators usually compete in a given market or activity. As such it is often not considered as having to be regulated.

In Bangladesh however, most downstream activities are indeed natural monopolies: bulk marketing and storage is conducted by state-owned M&D companies (even though a significant proportion of the shares belong to the public) that operate exactly in the same way and follow similar procedures; bulk transport is carried by the state's Bangladesh Railways or by privately-owned coastal tankers that actually operate under the umbrella of the Tanker Owners' Association.

BERC currently does the job for power and gas prices. While the Commission is also officially in charge of setting oil prices, the responsibility is de facto with the sole government, and BERC has nothing to do, as of now, with oil price setting.

BERC has (or could rapidly get) the technical expertise to take over from the government the computation of the economic cost components. We recommend that BERC be in charge of the whole process of revamping the price structure, once the government, as the policy maker, has agreed to do so. BERC should then be entrusted with the following tasks:

- Monitor the evolution of international oil prices (crude and products), determine the average landed price on month M_{-1}, and set on that basis the landed prices for the coming month;
- Compute the technical costs of the operators in charge of the domestic components of the oil chain, including transport, storage, marketing and distribution of oil products;
- Determine regulated prices (or maximum chargeable rates) for these activities, so as to protect consumers from the threat of abuse of dominant position. The prices should reflect the real technical costs of each activity, with no consideration to any political or social objective;
- Review the amount of the technical costs on a regular basis (it is commonly done every 3 or 4 years) in order to take into account the general evolution of the costs over time;
- Review with the operators the financial impact of any large-size investment that may require that a given tariff be adjusted;
- Set end user prices by the addition of international price and domestic elements.

BERC would then transfer to the government their recommendations for validation and enforcement following the procedures effective in Bangladesh.

6. LPG

6.1 LPG in Bangladesh: A Yet-to-Be Developed Industry

LPG is unfortunately far from having found its way in Bangladesh. The main reason lies in the government policy that has led to the fast and strong development of natural gas for households over the past decades, boosted by heavily subsidised prices associated to a flat price structure that *de facto* encourages the waste of energy.

Reduction in gas supply availability, in the form of both gas fields depletion and lack of transmission capacity, should lead the government to re-direct its energy policy towards the development of the energy carrier that looks as the best substitute for residential natural gas, i.e. LPG.

6.1.1 Current Situation

In 2010 LPG consumption reached 64,000 tons[10]. About ¼ is produced by BPC production sites: the ERL at Chittagong (13,500 tons) and the RPGCL stripping plant at Kailashtila in the northeast (4,500 tons). Domestic production is directly linked to the output capacity of both the refinery and the gas plants, which puts a ceiling on the volumes available in Bangladesh from domestic sources. The balance (46,000 tons) is provided by imports, generally from the Singapore area.

BPC markets LPG either directly through the M&D companies (Jamuna, Meghna, Padma) and SAOCL, a lubricants marketing company that has developed an LPG activity or through selling part of its production to two private companies, BOC and Jamuna Spacetech (no connection to JOCL). Three other private companies operate the whole value chain in an independent fashion, from imports through marketing the product to end-users. These are: Totalgaz, Kleenheat and Bashundara. A fourth company, Jamuna Summit, is currently inactive but plans to get back into business. The private sector developed in the end of the 1990s and the beginning of the 2000s when the government opened the access to the market to cope with the increasing demand that domestic production could not meet.

Private imports facilities (reception and primary storage) are located near Chittagong (Totalgaz) and at Mongla Port (Kleenheat and Bashundara), where Jamuna Summit is also located. The primary storage capacity is well over the current level of sales, which account for only 28% of the available capacity.

Each company operates one bottling plant. The plants of the importing operators are located at the reception and storage premises, i.e. Mongla (Kleenheat, Bashundara and Jamuna Summit) and Chittagong (Totalgaz). There again, the plant design capacity of the bottling plants is quite larger than the current level of sales. BOC and Jamuna Spactech each operate a bottling plant at Bogra, while LPGL, a company under BPC, has bottling facilities located at Chittagong (for LPG produced at ERL) and at Kailashtila (for LPG available from the gas fields).

6.1.2 Barriers and Recommendations

As briefly mentioned above, declining natural gas supply availability paves the way for a strong development of LPG, not only in the residential market but also in the cottage industry and in dedicated commercial and industrial activities where gas (whether natural gas or LPG) is the

[10] Industry sources.

preferred choice, such as hotels and restaurants, food, textile, ceramics, glass and metal surface treatment, etc. Indeed the upside potential for LPG in Bangladesh is enormous. As one simple comparison, LPG demand in Morocco, a developing country with a population of only one-fifth of Bangladesh', reaches 1.7 million tons – over 25 times the consumption in Bangladesh.

However, there are several barriers that hamper the development of LPG, which need to be tackled in order for the industry to grow and to overcome, at least to some extent, the adverse consequences of the lack of natural gas. We generally support the concept of a "Road Map" proposed by the industry to develop the LPG market in a sustainable way, i.e. in a way that allows sufficient predictability for the operators to undertake the investment that such development requires. We have identified three areas where governmental action is required.

Pricing

Subsidies and dual-pricing structure

LPG is sold under a dual-pricing system. Private operators set their own end user prices and sell those at market price – which are not subject to any price control. Conversely, the government sets 'BPC' prices (through the BERC). Controlled prices theoretically follow the evolution of international LPG market prices. However, in the recent past, BPC prices were set far below international price (at the time of our last mission in June, 2011, price of a BPC 12.5 kg cylinder was set at Tk 700 whereas 'private' cylinders sold at around Tk 1,100), which makes LPG from BPC companies substantially subsidised.

Price distortion creates what generally happens in countries with a dual-pricing system: once the priority customers (government offices and companies, army, etc.) are supplied at subsidised prices, a significant portion of the remaining cylinders are *de facto* sold in the black market at prices close to private cylinders.

We propose that the subsidies, which prove to be largely inefficient (at the end of the day the subsidies do not benefit the targeted population), be progressively removed and that all LPG be sold at real prices. In the mean time, related measures should be devised and implemented in order to curb end user prices and make LPG more affordable (see below).

Taxes and duties

Like other oil products, LPG (as a product) is subject to a 10% overall tax, including 5% custom duty (CD) and 5% Advanced Income Tax (AIT). It is not subject to VAT and can be considered a reasonable government take.

Conversely, LPG equipment is heavily taxed. Imported cylinders are subject to an overall 25% tax (CD: 5%; AIT: 5%, VAT: 15%), the tax rate is even higher for ancillary equipment (regulators, valves, hoses) subject to a 10% CD – 30% in total.

Decreasing overall government take would materialise a strong government policy in favour of LPG development. Financial simulations need to be performed to determine (i) which type of tax should be decreased or eliminated; (ii) to which level these taxes should be curbed; and (iii) to which extent the elimination of current subsidies would compensate (at least partially) the required governmental effort.

Obviously, removing taxes is another form of subsidies. However, this 'new' subsidy appears much sounder than the current system: (i) it really reaches all of the targeted population without discrimination as it benefits all LPG users (and not only some middlemen); (ii) it tends to develop the market through more affordable prices; and (iii) it creates a better, more sustainable business climate as all operators are treated in an equal, non discriminatory fashion.

Financing upfront investment

It has been commonly observed in many countries (such as in Sub-Saharan Africa where inefficient subsidy policies tend to actually hamper the development of LPG) that the main barrier to LPG development is the high cost of the LPG equipment, rather than the price of the product *per se*. In fact, experience shows that biomass, the common substitute for LPG among lower income population, is often more expensive, on a BTU basis, than LPG. However, most households keep using fuel wood and charcoal because they just cannot afford financing the cost of the first equipment.

In Bangladesh the cost of a new LPG connection is about Tk 5,000 [11] (70 USD), broken down into:

- Cylinder (empty): Tk 1,700 to 2,000
- First load (LPG): Tk 1,100
- Burner/Stove: Tk 1,500
- Regulator: Tk 350
- Hose and clips: Tk 150

Reducing or eliminating taxes on LPG and equipment would reduce the cost of upfront investment by about Tk 1,000 at most. While this is far from being negligible we believe that additional actions should be undertaken to create a real, efficient momentum. One option is to devise a financial tool that allows targeted populations (middle and lower-middle income groups) to permanently shift to LPG. Such tool could be in the form of pre-financing a substantial part of the upfront installation (supplied at a nominal fee to households to avoid wastage) and recovering the loan through monthly instalments paid on every LPG load over a medium term period (say, 24 to 36 months). As an example, recovering a loan of Tk 4,000 over 3 years (54 loads @ a consumption rate of 1.5 cylinders per month) would add an additional Tk 75 [12] on each load. The pre-financing would be funded by the government through either its own budget or a credit from an MFI such as ADB. The amount to be borrowed is reasonable (7 million USD for a batch of 100,000 households equipment).

Urban and construction regulation

In addition to individual equipment, the development of LPG should be encouraged in multi-storied buildings and compounds. This can be done through devising specific regulation that encourages the installation of LPG equipment in new buildings (residential buildings as well as private and government commercial premises, such as hotels, hospitals, community buildings) from the outset. It could be made compulsory that both private and government developers install LPG equipment (service line, internal piping, LPG container and loading area, meters and regulator) in newly built or refurbished buildings, so as to be ready for bulk LPG service. Such regulation should be accompanied by a set of appropriate technical and safety regulation.

Another action should be to withdraw the present regulation that prevents industrial premises from using LPG when connected to natural gas.

Safety regulation and good business practices

A key action is to devise (and enforce, whenever the regulation already exists but may not be strictly enforced) dedicated technical and safety regulation, in order to:

- Ensure a safe utilisation of LPG for people and goods (LPG remains a hazardous material where used inappropriately);

[11] Source: LPG industry.

[12] Not including financial cost (interest).

- Eliminate bad practices; and
- Develop a sound and competitive business climate.

Among the measures that should be focussed upon:

- Ensure common rules and equality of treatment for all operators and stakeholders;
- Prevent illegal filling of cylinders that belong to a different operator;
- Allow only safe and approved cylinders and appliances, manufactured to internationally recognised safety standards and norms, which makes it necessary for Bangladesh to set up or review its dedicated legislation and regulatory framework;

7. Corrections made to the report

Following up the comments from BPC of the 03/01/2012, sent to the consultant on the 21/11/2012, the corrections below have been made:

Comment made:

(1) Chapter 1:

(a) Storage capacity to be increased at Main installation of Oil Marketing Companies in Chittagong to keep sufficient stock position and smooth discharge operation of petroleum products

(b) Proposed 14 days ADS storage is not sufficient; it must be at least 30 days at main installation in Chittagong and big depots such as Baghabari, Godnaile/Fatullah and Daulatpur as well as at least 20 days stock to be maintained as small depots

Correction made:

In chapter 2.2, a specific paragraph has been added in the introduction and 2.2.2 is designed to propose the ADS 30 days.

Comment made:

(4) Chapter 4:

Selling price of petroleum products should be determined by the Government on the basis of policy concerned. Price formula for import of petroleum products should be maintained on basis of Platts FOB AG for Gasoil, Kerosene/Jet A-1 and Mogas.

Correction made:

Chapter 5.4.1 (last paragraph) has been modified to answer to the comment above: “The periodically revised international prices should be based on the figures published by independent, widely acknowledged sources, such as e.g. Platt’s, using FOB figures for the geographical locations where Bangladesh is mainly supplied from, e.g. Arabian Gulf for liquid products and Singapore for LPG.”

Also, in the part 5.4.2, the following sentence has been added:

“BERC has (or could rapidly get) the technical expertise to take over from the government the computation of the economic cost components”