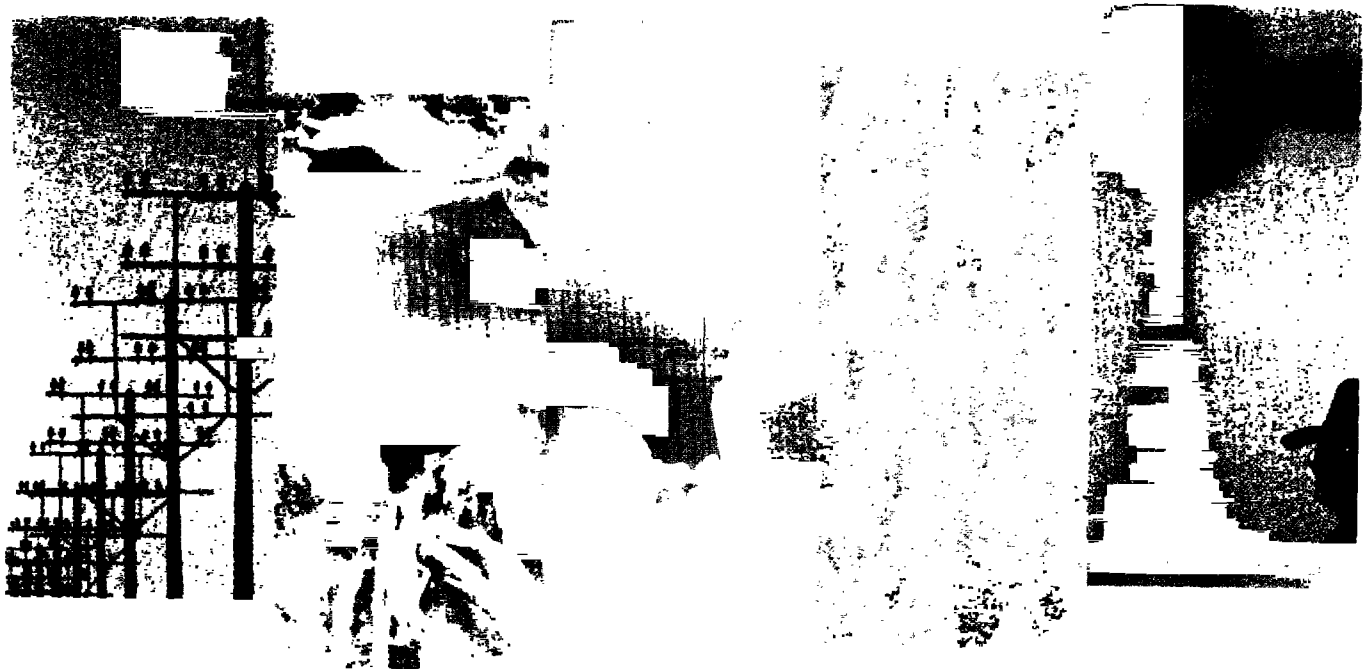


*First World Bank Workshop on the Petroleum
Products Sector in Sub-Saharan Africa*

ESM245



Energy

Sector

Management

Assistance

Programme



Report 245/01
September 2001

JOINT UNDP / WORLD BANK
ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAMME (ESMAP)

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ESMAP Management"

**First World Bank Workshop
on the Petroleum Products Sector
in Sub-Saharan Africa**

**Johannesburg, South Africa
May 19–22, 1998**

September 2001

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Foreword

The World Bank's objective is to stimulate development by helping its member countries create the conditions for broad-based economic growth—development, as it were, with a human face. Although traditionally this assistance has been financial in nature, increasingly it has needed to be supplemented, and in some case supplanted, by development of *knowledge* through both dissemination of information and direct human development. The Bank has come to the conclusion that the most effective reform is reform from within, led by its member countries, with the Bank helping to disseminate best practices across borders. It is in this light that the Bank sponsored this first petroleum workshop, generously supported by the Energy Sector Management Assistance Programme (ESMAP) and the Kingdoms of Denmark, Netherlands, and Norway.

The workshop focused on the downstream petroleum sector, a sector that dominates the economies of the poorer two-thirds of Sub-Saharan countries. For many reasons reform in this area has not been a priority, but it should have been. Typically one-quarter of these countries' import bill is for petroleum, and even a small percentage saving can improve a country's overall balance of payments from critical to comfortable. The economic cost of unreliable supplies is substantial—often as much as ten times the import cost—when in fact reliability can be achieved through small, low-cost reforms. There are numerous examples of rotting crops that could not be delivered to market because of lack of diesel fuel in the rural areas; of near-bankruptcy caused by inappropriate pricing policies and systems; and of chains of mutual non-payment that have destroyed economic systems. Environmental protection and worker safety are other casualties in this sad state of affairs. Fortunately, the solution requires mainly the knowledge of what can be done and how to do it—and the political will to deal with the transition.

The workshop was not able to tackle all the issues at once. Information gathering is often crucial, and it takes time to move from anecdotal evidence to well-documented cases, and still more time to identify best practice. In addition, an element of personal risk was involved in the research: our road safety consultant, for example, found that truckers didn't want their questionable practices to be recorded.

But that's what is needed—to avoid the theoretical and look at the real life of Africa. The continent's small economies, poor communications, and political realities call for innovative solutions that come from within. A follow-up workshop on another set of issues will take place in late 2000, at which point we will be better positioned to assess both the need for further research and ways to perpetuate the workshop experience through a suitable institutional arrangement.

Charles McPherson
Manager, Oil and Gas Policy Unit
The World Bank

Preface

1. The petroleum trade figures large in Sub-Saharan Africa. Of the countries that import it, it is typically the biggest item on the overall list of imports; of the six countries that are its chief exporters, it dominates export earnings. Consequently, improving the efficiency of the petroleum sector in Africa can bring great rewards. A World Bank study carried out in the early 1990s estimated the annual inefficiencies in the downstream part of the African petroleum sector to be equal to the International Development Agency's (IDA) annual support for Africa—that is, in excess of US\$1 billion. Progress on addressing these inefficiencies has been limited.

2. The objective of the World Bank's first workshop was to help countries learn from each other about reforming the downstream petroleum sector, so that those who have yet to undertake reforms can benefit from those who have already gone ahead. It was hoped that doctrinaire agenda and preconceived solutions could be replaced by mutual efforts to understand what works best in the African context.

3. Held in Johannesburg, South Africa, on May 19-22, 1998, the workshop consisted of formal presentations, plenary sessions, group discussions, and lively debate. There were frequent opportunities for participants to get together and follow up. The six subjects were as follows:

- a. Petroleum procurement via the Standard Bidding Document
- b. Harmonizing product specifications
- c. Petroleum road transport safety
- d. Petroleum transport options
- e. Regional trade in liquefied petroleum gas (LPG)
- f. Product regulation and pricing.

4. Although the workshop was unable to cover all the issues involved, it should be seen as an attempt to initiate a discussion on a few of the sectors' many problems. It was apparent that active follow-up is needed on product specifications, to develop a consensus in sub-regional groups, and that more work is needed to determine:

- a. Petroleum product pricing
- b. The situations in which liberalization might work
- c. The problems and solutions in price adjustment systems
- d. The uneven level of margins across the continent
- e. How to go about regulation.

Another set of issues that was always just below the surface included refineries, refinery economics, and the various constraints that have limited options in the past. These issues will have to be left for a subsequent workshop.

5. While consultants and Bank staff made the formal presentations, the delegates led the group sessions and presentations. Copies of the presentations were given to all the delegates, together with comprehensive reports on petroleum procurement, product specifications, and pricing (including a "model" petroleum pricing regulation from one of the participating

countries); these are available on request from the Oil and Gas Policy Unit of the World Bank. The workshop also benefited from two luncheon speakers representing one of the major oil companies and one of the reformist governments, respectively. These added perspective and first-hand input. Summaries of the papers presented follow.

Acronyms and Abbreviations

FOB	free-on-board
LPG	liquefied petroleum gas
RON	research octane number
SADC	Southern African Development Community
SSA	Sub-Saharan Africa
SBD	Standard Bidding Document

Units of Measure

bcm	billion cubic meters
kPa	kilopascal
MT	metric ton

1

Petroleum Procurement: The Standard Bidding Document

Executive Summary

1.1 The World Bank's Standard Bidding Document (SBD) for procurement of petroleum fuels was presented and explained. Even before its formal introduction in May 1997, the document in its draft form was in use in several countries for World Bank and other donor-financed procurement. Importers using the SBD have gained considerable savings through competition, providing confidence and equal access to bidders, and establishing transparency in bidding and bid evaluation. It is estimated that the savings could reach about US\$200 million per year if all major consumers in Sub-Saharan Africa (SSA) use the SBD for their petroleum procurement. The cooperation and help received from the client countries and oil trading community were, to a great extent, responsible for the easy acceptance of the SBD by the buyers and sellers and its success. Participants in the May 1998 Johannesburg presentation of the SBD strongly supported its use and recommended formal training of personnel for its increased application.

Background

1.2 The World Bank has been participating actively in the development of petroleum distribution and marketing throughout Africa since the early 1980s. The Bank has funded several infrastructure facilities, organized training of technical and managerial personnel, and provided financial assistance in order to improve efficiency and reduce cost, create technical and managerial skills in the sector, and, in some cases, provide balance of payments support. Experience gained through these operations indicated ways to establish transparent commercial practices and reduce costs, and the competitive procurement of petroleum fuel through use of the SBD is one of them.

1.3 Based on experience gained in using the Bank's simplified draft bidding documents and comments received from major oil companies and oil trading companies, a trial edition of the SBD was introduced in May 1997 for all Bank-financed procurement of crude oil and petroleum products in SSA. Some of the donor agencies also started using the SBD when their financing was involved. Since its introduction, the SBD has been in use in such countries as

Burkina Faso, Central African Republic, Guinea Bissau, Mozambique, Sierra Leone, Uganda, and Zambia. The process so far has been successful in establishing transparency and obtaining competitive prices from the international market for crude oil and petroleum products.

1.4 The trial edition was prepared in accordance with the provisions of the World Bank procurement guidelines.¹ In order to meet the international petroleum market conditions within the scope of these guidelines, extensive references were made to the standard terms and conditions used by several major oil marketing companies for CIF contracts. The document therefore is designed to meet Bank's guidelines, protect borrowers' interests, establish transparency in the procurement system, and give bidders confidence and equal access.

1.5 Those provisions intended for use unchanged from transaction to transaction are grouped in Sections II (Instruction to Bidders) and in Section IV (General Conditions of Contract). Data and provisions specific to each procurement and contract should be included in Section III (Bid Data Sheet), Section V (Special Conditions of Contract), and Section VI (Specification and Schedule of Requirements). A sample format for Invitation for Bids in Section I and Forms that will become part of the contract in Section VII are provided. Amendments, if any, to the Instruction to Bidders and to the General Conditions of Contract should be made through the Bid Data Sheet and the Special Conditions of the Contract.

Justification for SBD and Competitive Bidding

1.6 International competitive bidding using the World Bank's Standard Bidding Document (SBD) will lead to better and fairer competition and to lower costs. Bulk transport cost can be reduced considerably if larger cargo sizes can be arranged. Currently, based on the water depth and berth facilities available at various ports, cargoes in the 25,000–30,000 MT capacity range should be the smallest size that will attract low-cost proposals for ocean transport. It is estimated that rigorous international competitive bidding for such cargo sizes can save about US\$200 million per year in SSA. This can be achieved easily by pooling the requirements of a few oil companies or oil-importing countries. However, such pooling would require greater transparency, equal access to suppliers, and coordination of tanker arrival times. Competitive bidding using SBD in several Sub-Saharan African countries has demonstrated how easily pooling can be achieved. Currently several countries have adopted SBD for their own product procurement even when not World Bank-financed. Delegates who attended the May 1998 Johannesburg presentation of the SBD strongly supported its wider usage and recommended formal training of personnel in its usage.

Main Features of the SBD

1.7 **Advertisement:** Sufficient publicity through advertisement is essential to generate interest among Bidders. For all World Bank-financed procurements, it is mandatory. The recommendation is to advertise in at least one newspaper of general circulation in the borrower's country and in the official gazette, if any. Also recommended is either (a) a letter addressed to

¹ *Guidelines: Procurement under IBRD Loans and IDA Credits*, January 1995, revised in 1996. For current version (revised 1999) see <www.worldbank.org/html/opr/procure/guidelin.html>.

bidders who, following the publication of the General Procurement Notice, have expressed interest; or (b) optionally, a circular to consular or diplomatic representatives of countries with potential bidders.

1.8 **Invitation for bids:** Invitation for bids should follow the general procurement notice. It is important to indicate the source of funds in the invitation since it provides confidence among the bidders. There have been instances where cost of financing and banking charges were reduced considerably when a source of funds such as the World Bank is confirmed.

1.9 **International Competitive Bidding:** To achieve maximum and transparent competition, the bidding should be conducted through international competitive bidding procedures specified in the World Bank's guidelines. This is mandatory for all Bank-financed procurement. Even when Bank financing is not involved, international competition is the essence of least-cost procurement with most advantageous terms and conditions.

1.10 **Sealed Bids:** When public funds or international borrowing for the procurement is involved, it is essential to provide transparency, confidentiality, and equal access to all eligible Bidders through the use of sealed bids that will be opened in presence of bidders' representatives at a location and time indicated in the bidding document. Although in other cases it is a common practice in the petroleum industry to conduct trading by facsimile and other electronic means because of the transparency issue, we do not recommend it.

1.11 **Instructions to Bidders:** These instructions provide all the information necessary for bidders to prepare responsive bids in accordance with the requirements of the Purchaser and should lead to fewer bids being rejected for non-compliance. Provisions should not be changed; however, if a change is essential, it should be reflected through the bid Data Sheet in Section III.

1.12 **Clarification of bids During Evaluation:** There should be no oral communication from the time that the bids are received until the award is announced. During evaluation of the bids, the Purchaser may ask clarification from the bidders, but the request must be in writing and the response also should be in writing. However, there should not be any change in the prices or substance of the bid as result of such clarifications and response.

1.13 **Evaluation and Comparison of Bids:** Only bids that have been found substantially responsive as a result of preliminary examination should be evaluated and compared by the Purchaser. The evaluation and comparison should be based on CIF prices. These should be computed by the Purchaser for the bid opening date through summation of FOB spot prices based on Platt's Oilgram Price Report quotation, fixed cost for ocean freight for the size of tankers specified in the bid, insurance, ocean loss, and cost of inspection, if any. Because it is important that all bids be made on a comparable basis, fixed FOB price and variable costs of freight, insurance, and ocean loss are not allowed. The SBD does not include special provisions required for inland transport cost to landlocked countries. Also, the SBD is designed to cater for contracts that extend to periods ranging from 6 to 12 months because the evaluation is based on spot FOB prices and going tanker rates.

1.14 **Award of Contract:** The Purchaser should award the contract to the Bidder whose bid has been determined to be lowest as well as substantially responsive. At this point, executing the performance guarantee as per the standard format provided in the bid document, within the time specified, should be the only remaining requirement from the successful Bidder.

1.15 **Post-Qualification:** In the absence of pre-qualification, the Purchaser should determine to its satisfaction whether the selected Bidder is qualified to perform the contract satisfactorily.

1.16 **Bid Security:** A Bid Security is required mainly to protect the Purchaser against risk of bidder misconduct. For this reason the language of the bid security is important and should be acceptable to the Purchaser. It should be unequivocal. Although a number of well-established oil companies claim that the bid security and performance security are an unnecessary cost, there have been many examples where the security has had to be called, and the potential cost savings of dispensing with this security are not worth the risks.

1.17 **Performance Security:** As in the case of the Bid Security, the Performance Security is required to protect the interests of the Purchaser. Failure to furnish the Performance Security in a language satisfactory to the Purchaser shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security.

1.18 **Appointment of Independent Inspectors:** There have been cases of unsatisfactory product being shipped to African buyers. To minimize this, and to clarify liability, appointment of independent inspectors is valuable. The Seller or its Supplier will appoint Independent Inspectors at the loading port and the Purchaser at the unloading port or ports. In both cases, the selection of Inspectors shall be mutually acceptable to both parties; and their findings, supported by analysis of sealed samples taken by them, shall be binding on both parties for verification and resolving disputes on quantity and quality of the cargo.

1.19 **Price Payable:** The price payable by the Purchaser is computed on the basis of spot average FOB quoted in Platt's Oilgram Price Report. The average will be calculated around the date of Bill of Lading. If the price publication is delayed for more than one week or the spot market prices are totally out of tune with the ongoing market prices, the FOB prices basis should be discussed and mutually agreed upon in writing before loading.

1.20 **Credit Period:** The SBD provides only a fixed period of 30 calendar days from the Bill of Lading date. Bids whose credit period is lower than 30 days will be non-responsive because they present financing difficulties. Bids whose credit period is greater than 30 days will not be given any extra weight in the bid evaluation, because it is for the Purchaser to make separate financing arrangements with a financing institution.

1.21 **Delivery, Title, and Risk of Loss:** Even though it is a CIF contract, it is standard international practice (and is the contractual position) that delivery of the cargo shall be deemed completed at the loading port as the cargo passes the flanges connecting the Supplier's delivery facilities to the loading connections of vessel provided by the Seller. At that point the title and risk of loss, including damage, deterioration or evaporation, passes to the Purchaser. Thereafter, no transshipment of cargo, intermediate storage, or supplement cargo via ship-to-ship transfers shall be permitted. No commingling of the Purchaser's cargo with that of others on the vessel shall be permitted.

1.22 **Insurance:** The Seller shall procure and pay for insurance of the cargo against marine and all other risks, including contamination, deterioration, leakage, evaporation, and shortage exceeding 0.5 percent of the Bill of Lading quantity, from shore tank at the loading port to shore tank at the unloading port or ports, for an amount equivalent to 110 percent of the total

CIF price of the cargo. The benefit of such insurance shall accrue to the Purchaser. Insurance against war risks, if asked for by the Purchaser, shall be purchased at extra cost to the Purchaser.

1.23 **Demurrage:** The Purchaser shall pay demurrage if, after verification by the Seller, the allowed laytime is exceeded at the rate specified in the charter party. In no event shall the Purchaser be liable for payment of demurrage in excess of that amount actually paid to the vessel by the Seller for that particular cargo.

1.24 **Bid Form and Price Schedules:** These forms are an important part of the bid document. They contain all the basic information required for bid evaluation and selection of the winning Bidder. It is essential that the Seller understand all these provisions and footnotes thereof and that they be signed by an authorized representative.

1.25 **Letter of Indemnity:** The Seller is obliged to provide letter of indemnity (LOI) to the Purchaser to cover the loss of documents or delays in the shipment of documents. The format of the LOI should be mutually acceptable to both parties and should include title of the cargo, indemnity against non-production of documents, right to deliver bills, legal cost, governing law, and an obligation to put the receiver of the indemnity to funds.

2

Petroleum Product Specifications: The Case for Quality Improvement and Regional Harmonization

Executive Summary

2.1 Also presented at the May 1998 workshop were the results of a consultant review of existing product specifications, refinery facilities, and automobiles that consume petroleum products, including recommendations for harmonizing product specifications on a regional basis. The participants included representatives from various governments in East, West, and Southern Africa and oil marketing companies operating in these countries. In general, the delegates concluded that cleaner fuels should be made available to reduce pollution from automobile emissions, and that regional product specifications should be harmonized to achieve better prices, facilitate cross-border trade, and create support arrangements for security stocks. Products recommended for this harmonization process were gasoline, diesel fuel, and LPG (LPG was not included under the scope of the study), whereas fuel oil was left out with the suggestion that its specification should match those widely available in the international market.

2.2 Because unleaded gasoline is both healthier and cheaper than leaded gasoline, it was recommended that use of the latter should be phased out. Alternative arrangements should be made for achieving the necessary octane levels in local refineries. The workshop further recommended a two-pronged approach: early introduction of unleaded gasoline and reduction of lead in leaded gasoline to the current European low-lead level (0.15 gram per liter). The leaded gasoline would be phased out subsequently. It was to be noted that price quotations for leaded gasoline would have ceased by the end of 1999 in recognition of the limited demand for it. The excess cost of leaded gasoline compared with unleaded is expected to grow. For diesel oil, it was agreed that sulfur content should be reduced initially to 0.5 percent and subsequently to 0.2 percent. The general consensus of participants was that although the local refineries would have difficulty in meeting international product standards, it was for the countries, not the refineries, to decide the standards on health, environmental, and fuel efficiency grounds. In accordance with the recommendations of participants, the economic viability of existing refineries in Africa and additional cost of producing international-quality products in these refineries would be covered separately in the next petroleum workshop.

Background

2.3 Current petroleum product specifications in Africa do not reflect (a) the technological requirements of the engines or burners that use the products, (b) standard manufacturing specifications in the international market, (c) climate conditions, (d) cost effectiveness to the consumer, and (e) requirements of safety and environmental protection measures. In many cases, they are specifications designed for the cold weather conditions prevailing in Europe, and are not updated in areas where specifications have been changed in Europe to improve environmental protection. The processing facilities of existing refineries, which are often more than 30 years old, have not been improved to meet current quality requirements for petroleum fuels. Consequently, these refineries market sub-standard products, but charge for them as though they were supplying in accordance with European specifications. In some extreme cases, gasoline of 83 research octane number (RON) with a lead content of 0.7 grams per liter is being marketed. Automotive diesel containing more than 1.0 percent sulfur is being marketed at prices higher than the international price for diesel containing 0.2–0.5 percent sulfur. Because of this, the World Bank launched a review of the existing product specifications, refinery facilities, and the inventory of automobiles that consume most of these fuels to (a) recommend suitable measures to improve quality and pricing and (b) harmonize regional specifications, wherever possible, to achieve efficiency in procurement, storage, and distribution, and to reduce the delivered cost of petroleum fuels.

Review Findings

2.4 The review methodology involved information gathering from existing World Bank files, visits to countries with main supply points and/or refineries, collection of information through solicitation of oil marketing companies, and reference to the consultants' own in-house data. The review, conducted under terms of reference prepared by the World Bank, was carried out with the objectives of understanding current situation with respect to:

- a. Product specification and supply constraints
- b. The environmental impact of existing specifications
- c. Investment and operating cost constraints for improving specifications
- d. The potential for harmonizing regional specifications with a view to pooling the requirements of several countries (thus reducing procurement and transport costs)
- e. Minimizing the constraints in existing infrastructure for bulk handling and distribution of petroleum products.

2.5 Gasoline: Many countries continue to market two grades of gasoline, premium and regular, both of which contain high concentrations of lead. Unleaded gasoline has been introduced only in South Africa, where all existing refineries have been modernized to produce 95 octane gasoline without lead. The octane rating for premium gasoline ranges from 93 in Gabon, Kenya, Tanzania, and Zambia to 95 in Cameroon, Côte d'Ivoire, Senegal, and South Africa. Currently, the octane number for regular gasoline varies from 83 RON in Tanzania to 87 RON in Kenya, Zambia, and Senegal. Consumption of this grade is rapidly decreasing except in Kenya, where consumption has fallen but still remains at about 140,000 MT/yr. In most other countries it has come down to below 10,000 MT/yr. and many, therefore, are likely to remove

this grade from the market to reduce the cost of segregating two products in the marketing network. The lead content in both grades ranges from 0.37 percent to 0.8 percent, except in South Africa.

2.6 In general, countries in the East and South maintain 93 RON and countries in the West keep 95 RON. From the point of view of automobile engine performance, the manufacturers recommend 95 RON. However, most of the high gasoline consumption areas in the East and South are at altitudes over 1,000 feet above sea level, where gasoline 2 RON lower gives the same performance as 95 RON gasoline gives at sea level. Almost all high-gasoline-consumption areas in the West are less than 500 feet above sea level. Therefore, from a technological standpoint, 95 RON in countries in the West is found to be desirable.

2.7 The current processing facilities in refineries in SSA, with the exception of South Africa, are not designed to produce 93 or 95 RON gasoline. As a result, these refineries can produce 93 or 95 RON gasoline only with a maximum dosage of lead, which is four to five times higher than 0.15 grams per liter in internationally traded premium grade gasoline. Because the cost of producing, transporting, and handling lead components is constantly increasing, unleaded premium gasoline on the international market is available at a lower price (about US\$4/MT) than the same-octane premium gasoline with lead. Refineries in SSA need either substantial investment to upgrade gasoline production facilities or importation of costly octane enriching components such as reformat, alkylates, isomerates, and other options to reduce lead content to 0.15 grams per liter in gasoline. In the long term, the governments concerned need to choose between importing lead-free gasoline or supporting the heavy cost of new refinery investment and importation of octane-boosting components. In the short term, the solution is to reduce lead content to 0.15 grams per liter to make premium gasoline of 93 RON with minor modifications in the processing facilities and, to the extent required, import relatively smaller quantities of octane-boosting components.

2.8 In countries on the west coast of Africa, 95 RON gasoline is technically desirable. However, the processing facilities of local refineries may not be able to achieve this goal. Each country should weigh the cost of producing 95 RON premium gasoline (for more efficient engine performance) against the relatively lower cost of producing 93 RON gasoline, which will increase fuel consumption by about 10 percent.

2.9 Among other properties of gasoline, only front-end volatility and the presence of light ends (mostly butanes), as measured by Reid vapor pressure, need some adjustments. The front-end volatility can be controlled by specifying the 10 percent distillation volume at 70 degree C. maximum, and the presence of light ends by specifying Reid vapor pressure at 70 kPa maximum (10 pounds per square inch at 100 degrees F.).

2.10 Automotive Diesel: For diesel fuel, three properties were found to be problematic: the cetane index (or diesel index), pour points, and sulfur content. Refineries in west coast countries process mainly the low-sulfur, waxy crude oils readily available from the West Africa region, and are able to meet targets of less than 0.2 percent sulfur content and 45–48 cetane index. The pour point, which does not reduce the engine performance of the diesel, can pose problems with respect to cold-temperature starting. Since almost all countries in West Africa are in the warm region, this should not pose a problem if the existing specification is revised to meet the climate conditions in West Africa. In many countries, the current pour-point specification is

kept at 0 or minus 2 degree C., as in cold countries in Europe. If it is raised to 3 to 6 degree C., there will not be any problem with respect to engine performance; at the same time, production of diesel in the refineries can be increased (currently refineries lose diesel production since the product has to be manufactured with a lower distillation end point due to the lower pour point specified).

2.11 In the case of east coast refineries, where Middle East crude oils are processed, there is no problem with respect to cetane index and pour point. However, there is a major problem in meeting the goal of lower sulfur content in that the refineries do not have sufficient capacity for desulfurization of diesel. Therefore, current manufacturing specification from these refineries is 1 percent sulfur (maximum) as against 0.2 percent in the international market from which diesel is imported into these countries. In the absence of low-sulfur crude oils in the region, there is no other choice but to import low-sulfur diesel or make substantial investment in the refineries for desulfurization facilities.

2.12 Fuel Oil: The only property that poses a problem for the fuel oil is sulfur content. Refineries in the West coast do not have any problem since the low-sulfur crude oils they refine produce fuel oil of 0.2 percent sulfur (maximum) as against 1.0 percent maximum for low-sulfur fuel oil in the international market.

2.13 Refineries in the East and South refine high-sulfur crude oils from the Middle East, and resultant fuel oil contains about 3.5 percent sulfur. There is no cost-effective way to reduce sulfur content in fuel oil from these refineries. However, local consumption of fuel oil in the region is relatively small. The problem should be addressed as and when major fuel-oil using plants (such as power plants) are considered in heavily populated areas, in which case imported low-sulfur fuel or efficient flue-gas desulfurization facilities in the power plant should be considered.

Recommendations

2.14 Gasoline: Because of the health hazards associated with lead, its blending in gasoline should be eliminated in line with the practice in rest of the world. However, due to practical difficulties experienced in the refineries in SSA, the elimination process could take place in phases. In the first phase, during the first three years, the lead content in gasoline should be reduced to 0.15 grams per liter maximum; in the second phase, at the end of the three years, the lead content should be completely eliminated. There is no need for two grades of gasoline in the future. The low-octane gasoline should be phased out at the same time as the unleaded is phased in.

2.15 Front-end volatility of gasoline should be controlled by limiting the 10 percent volume distillation point at 70 degree C. maximum. Also, light ends in gasoline should be limited by specifying Reid vapor pressure at 70kPa maximum (10 pounds per square inch at 100 degree F.).

2.16 Automotive Diesel: High sulfur content in diesel is one of the major sources of atmospheric pollution because of the particulate matter generated when it combusts. Therefore, sulfur content in diesel fuel should be reduced to 0.2 percent maximum in line with the practice in most of the world outside of the United States and the European Union. However, due to the

financial cost for most of the refineries in East and Southern regions of Africa, the target could be achieved in two phases. In the first phase, within three years, sulfur content in diesel fuel should be reduced to 0.5 percent maximum, and thereafter it should be reduced to 0.2 percent maximum. This phased approach will in many cases allow the specifications to be met by blending low-sulfur imports with higher-sulfur local production.

2.17 In order to reduce particulate emission through partial combustion of automotive diesel fuels, the distillation end point of diesel should be limited by fixing 90 percent distillation point at 362 degree C. maximum. Also, kinematic viscosity at 37.8 degree C. should be within the range of 1.6 to 6.5.

2.18 Considering the warm climatic conditions in Africa, the cold flow property of diesel should be raised from European-oriented specifications on a regional basis. The exact limit could differ from region to region, depending on the coldest weather experienced in each region.

2.19 The Cetane index in automotive diesel should be harmonized at 48 minimum in all regions.

2.20 Fuel Oil: Due to the low-sulfur crude oil processed in all refineries in the Western Africa, sulfur content in fuel oil should be limited to 1.0 percent maximum. In Eastern and Southern Africa, two grades of fuel oil are recommended: one with 3.5 percent sulfur content, and another with 1.0 percent maximum for consumption in heavily populated areas.

3

Hazards of Transporting Petroleum by Road

Executive Summary

3.1 The record of road safety in petroleum transportation in Sub-Saharan Africa is poor, and the lack of sufficient statistical data in the public domain on petroleum transportation in the region has made it difficult to assess the magnitude of the problem. Therefore, the consultant team conducted extensive field visits to gather information on:

- Laws and regulations on transportation of petroleum
- Safety statistics
- Policies and procedures used by oil companies and petroleum transporters
- Current work practices
- Operation of petroleum vehicles at loading and discharge facilities and on the road.

The countries visited in this connection were Ghana and Côte d'Ivoire in West Africa, and Ethiopia, Kenya, Mozambique, South Africa, and Tanzania in East and Southern Africa. The team interviewed government officials, oil company staff in local and head offices, and representatives of transport companies, transport federations, and road safety organizations. Prior to the field visits, the international regulations and work practices of a few international oil companies in Europe were reviewed.

3.2 In general, the following opinions/views were heard from individual persons and organizations:

- a. There is a lack of awareness and respect for road safety among the public, which is also reflected in the lack of government policies and lack of adequate enforcement.
- b. There is a lack of awareness of the dangers and environmental concerns involved in the handling of petroleum.
- c. Efforts to improve road tanker safety should also include the general public, and road safety measures should be given priority in SSA.
- d. Appropriate laws and regulations should be adopted and be given wide publicity so that the public as well as industry members are aware of their existence.

3.3 Overall, transport of petroleum by road in SSA currently involves a number of safety hazards including bad roads, poorly maintained vehicles, low operational standards, lack of safety awareness, and weak enforcement of existing laws and regulations. A satisfactory resolution to this situation would require close cooperation from governments, oil companies, and transporters. They should jointly prepare a long-range action plan to address the issues involved. The oil companies, with their international experience and established standards, should take the lead in preparing such a program. The main features of the program recommended are summarized as follows:

- Establish a system to report petroleum transport accidents, including all details.
- Establish petroleum associations with mandates (see paragraph 8.3 in this chapter).
- Make insurance and accreditation of transporters mandatory.
- Develop licensing to ensure a basic requirement of competency for all operators.
- Establish transport tariffs that provide incentives to improve safety standards.
- Review the current oil company policy of outsourcing transportation requirements.
- Give high priority to enforcing laws and regulations.
- Establish a program to exchange best practices and other experience in the Sub-Saharan region.
- Give more publicity to petroleum safety.

Safety Statistics

3.4 Although general traffic accident statistics from the countries visited indicate increasing accident rates, there was no specific identification in these statistics of vehicles transporting petroleum products. Comparing data collected on the accident rates in Sub-Saharan countries with the accident rate indicators used in official statistics in Norway reveals that (a) the number of fatalities (per 1000 vehicles) is very high in most Sub-Saharan countries (albeit substantially lower in South Africa, Zimbabwe, and Namibia than in the rest of Africa) and that (b) the number of fatalities per accident is increasing in SSA, whereas in Norway the figure is decreasing.

3.5 Representatives of many oil companies and petroleum transporters voiced the opinion that a significant number of accidents attributed to the petroleum industry are actually caused by third parties. However, consultant research indicated that the general complaints of bad driving, badly maintained vehicles, bad road conditions, inappropriate attitude, and so on are equally applicable to petroleum carriers. Their contribution to fatalities is significantly higher than that of other types of carrier due to the high inflammability of petroleum. This makes it more desirable for the oil industry to take a lead role in setting essential standards.

Standards and Regulations

3.6 Among the limited number of applicable international standards, specifications, and regulations related to petroleum road transportation safety, the best known are the United

Nations Transportation Regulations and the European Community ADR.² These regulations could form the basis for individual country or regional regulations, as happened in South Africa.

3.7 International oil companies have their own standards, which are based on industry best practices in North America and Europe. Such organizations as the American Petroleum Institute, the National Fire Protection Agency of America, and the U.K. Institute of Petroleum have, through a series of industry agreements, translated such industry best practices into Codes of Practice. These are accepted by legislative and regulatory authorities as defined minimum standards for the construction and operation of petroleum facilities. Operating licenses and legally required insurance cover are issued subject to adherence to such accepted standards. Regular auditing by competent authorities ensures close observation of such standards. Experience indicates that internal international company standards normally exceed the specific requirements detailed in local legislation both in the OECD countries and elsewhere.

National Regulatory Regimes and Enforcement

3.8 The team observed that, in most of the countries visited, legislation covering transportation does not include regulations specifically for petroleum transport. Moreover, the lines of responsibility with respect to such regulations are not clear in most instances. For these reasons, there is a certain amount of confusion regarding the requirements to be met by oil companies and petroleum transporters. There have been cases where local representatives of oil companies are unaware of some of the existing petroleum regulations.

3.9 In many places it was observed that the enforcement agencies could not perform their work diligently due to lack of sufficient authority, resources, and training. In order to strengthen enforcement, it is recommended that (a) legal requirements be made clear to both the public and to the enforcement officers; (b) responsibilities for enforcement be defined; and (c) penalties for failure to meet legal requirements be defined. Further, the testing and inspection services could be contracted to competent agencies that could carry out pre-license inspections, and random inspections could be conducted by suitably trained enforcement agencies on the road.

Transportation of Petroleum & Oil Company Policies

3.10 With a few exceptions, petroleum products in the Sub-Sahara are distributed by trucks directly from the refineries and import terminals. The majority of the fleet consists of old second-hand trucks that are poorly maintained following importation into the country. Due to local conditions and the lack of good equipment and qualified personnel, there is a wide gap between policies and reality. Currently, a number of countries encourage new entrants, often local inexperienced operators, into petroleum marketing and transportation without enforcing requirements on skill and experience. Differing taxation regimes in neighboring countries often encourage unscrupulous cross-border trade based on instant financial gains at the expense of quality and safety standards. All these have contributed to an increase in the use of inexperienced drivers and badly maintained and overweight vehicles, resulting in degradation of the road

² Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR = Accord européen relatif au transport international des marchandises Dangereuses par Route). See <www.unece.org/trans/danger/publi/adr/adr_e.html>.

surfaces and of the environment in general. Regional cooperation among the countries involved should be encouraged to establish a common strategy to minimize such activities.

3.11 It has become common practice for African subsidiaries of international oil companies to out-source as many activities as possible. Although profit maximization is the main motive for this, the practice has increased transportation of petroleum products by contractors in poorly maintained vehicles. Even though it is a successful policy in Europe and United States, it has caused substantial deterioration in safety and environmental measures in SSA due to inadequate enforcement of the oil companies' standard policies regarding safety and environmental measures. The tests performed by the oil companies are insufficient and some vehicles are accepted when on safety grounds they should be rejected. The oil companies have moral (although probably no legal) responsibility to ensure that their contractors adhere to the oil company standards. They should increase their efforts to audit and inspect the facilities used by their contracting companies. They should also work with governments to enforce policies to improve service quality.

Roads, Vehicles and Driving

3.12 In general, road conditions in all countries in SSA are poor due to over-heavy vehicles and long delays in repairing small damage to the road surface. Although the main roads frequently pass right through villages, drivers do not reliably observe speed limits.

3.13 Vehicle condition is also generally poor. In some countries general cargo vehicles are converted for petroleum transport by mounting a large horizontal barrel on a flatbed goods trailer. Such conversions produce a tank trailer with a significantly higher center of gravity than is standard, seriously affecting the stability of the vehicle. Common vehicle faults include worn and mixed tires, bad brakes, faulty suspension, bad steering, missing or inoperative fire extinguishers, damaged lights, broken windshields, and unserviced engines. In spite of the checklists enforced by some of the oil companies, trucks with such poor conditions are allowed to be loaded at various terminals. On the other hand, oil company-owned trucks are in fairly good condition.

3.14 Compelling the oil companies to accept sub-standard contractor vehicles are a range of factors including a lack of checklist usage on a rigorous basis, the inadequate length of time taken to train the personnel involved, bad road conditions, and political pressures and threats of action in the form of strikes. Some of the positive signs observed are a defensive driving institute and workshop established by Shell Ghana and a licensed international inspection company (SITCA) providing vehicle testing facilities in Côte d'Ivoire.

3.15 Given the special requirements of potentially dangerous loads, the competency of the drivers operating petroleum trucks is very low. Very often they do not have sufficient knowledge about the inflammable and explosive nature of petroleum products and precautions required to handle them. Drivers do not observe "black spot" signs³ and take unnecessary risks. A general road-safety awareness program for all road users is essential for improvement of safety performance in petroleum transportation. There should be intensified mandatory training

³ Public authorities put up "black spot" signs at places on roads where there are many accidents.

programs to overcome the drivers' lack of knowledge and competence. Once the drivers are trained, tachographs should be widely used as a control and audit mechanism to enable the drivers to operate almost totally unsupervised once they leave the storage depots.

Handling of Dangerous Goods

3.16 The lack of legislation in many countries in SSA concerning handling of dangerous goods has left the public and some industry members unaware of many safety issues. Limits or rules should be established for volume limitations, hours of operation, vehicle and driver licensing requirements, essential safety and emergency equipment, parking and offloading area designation, routing limitations, and emergency response facilities and actions.

Regional and National Cooperation Initiatives

3.17 Regional organizations include the Southern African Development Community (SADC) and Southern African Transportation and Communication Committee (SATCC), the Common Market for Eastern and Southern Africa (COMESA), the Economic and Monetary Union of West Africa (UEMOA) and the Economic Community Of West African States (ECOWAS). However, issues related to vehicle inspection system, check lists, and standardized testing stations are not in their agenda. Currently one of the SADC committees is developing common vehicle standards for weight, axle load, length, width, height, and so on to make cross-border traffic easier. SATCC, headquartered in Maputo, is trying to harmonize and develop regulations for hazardous substances. The governments and oil companies should encourage such efforts. In some countries petroleum associations have been established that could help to promote safety.

3.18 Three international oil companies have formed an Industry Safety Steering Committee in the Caribbean and Central America that has published minimum standards for contractors, vehicles, and drivers. It is based on mutual confidence between government authorities and the oil companies, but it gives the authorities a basis for auditing the oil companies' control of the transport activities. This could be replicated elsewhere.

3.19 The mandate for a typical Petroleum Association should include the following:

- Collection and recording of safety statistics
- Motivation campaigns
- Petroleum vehicle inspection procedures at terminals and on the roads with checklists
- Weight control measure to prevent overloading
- Safety performance indicators
- Methods for tracking vehicle position
- Essential technical specifications for vehicles and attached equipment
- Night driving standards
- Measures to identify dangerous areas on the roads
- Training standards and programs for approved drivers
- Standardized transport contracting procedures

- Contingency plans and procedures to mitigate the effects of accidents
- Techniques for publicizing rules and regulations.

Transportation Options, Costs, and Liberalization

3.20 The hazard of petroleum transportation by road is growing in SSA as the number of vehicles increases and their quality standards deteriorate in the absence of any serious initiative to provide alternative transport modes for petroleum products. The hazards could be reduced considerably if suitable conditions are created for more petroleum to be transported in pipelines and by rail. Constructing new pipelines and railway lines may be difficult to justify on economic grounds. However, a regional approach by different groups of countries to pool their requirements, under standardized quality, transport volumes could be increased to make modernization/extension of existing pipelines and railway lines economically attractive for petroleum transport.

3.21 Africa has a few commercially viable pipelines (as in Kenya, Tanzania/Zambia, and Zimbabwe) and others may be justified. Many companies have resisted using existing railway lines even where there are no other alternatives except for poorly maintained roads. There are arguments against using more rail facilities due to inefficiency of rail system management, poor conditions of rail tracks, lack of sufficient tank wagons and locomotives, and pilferage. However, with cooperation from the governments, oil companies, and international donors, suitable remedial measures could be taken to mitigate these fears and maximize long distance bulk transportation of petroleum products by (a) using dedicated trains (which will increase the utilization efficiency of tank wagons and thereby reduce costs) and by (b) requiring the railway to operate competitively—i.e., reducing fees, eliminating theft, and delivering goods intact and quickly. In most of the countries, the truck owners' powerful lobbies could work against such programs, but the governments concerned should favor rail transport of petroleum products on the basis of safety, environmental protection, and overall national interest.

3.22 In many places oil companies and transporters mentioned that the transport profit margins prevailing under the current cost-plus product pricing structure do not cover the actual costs involved. As a result, transporters are forced to disregard safety regulations to increase their profit margins. A direct answer to this problem in a regulated pricing system is to review the cost of transportation, taking into account all the safety, environmental, and other regulations stipulated. Governments should give safety and environmental issues high priority when planning a regulatory framework and monitoring mechanism as part of any program for deregulation/liberalization of petroleum distribution.

Recommendations

3.23 The hazards associated with petroleum transportation by road in SSA could be reduced if the governments, oil companies, and transporters cooperate to establish a long-range action plan. In each country the oil industry, with its international experience, should take the lead and work with the government and transporters to establish basic standards. It is important that the governments and oil companies define clear responsibilities and agree on how to divide responsibilities. One ministry for each country should be made responsible for decisionmaking, in consultation with other ministries and government agencies as required. The oil companies and transporters should organize how they will work with the government institutions. During

the next petroleum workshop these ideas will be further developed, in consultation with representatives from governments and oil marketing companies, to prepare a time-bound action plan.

Role of National Governments

- The role of each country government should be to establish safety standards and liability, the need for insurance, and so on through legislation. To motivate self-compliance, the legislation should be clear and the penalties adequate. The government should then ensure that the laws are enforced, and for those countries not currently doing so they should assess why they are failing on their own laws. Governments have a responsibility to educate the public on safety matters.
- Each government should use laws and regulations to define the basic competency requirements of oil companies and transporters.
- In countries where prices are regulated, governments should review the transport margin to ensure that it does not lead to pressure to use sub-standard vehicles. Prices should be adequate to remunerate investments in safety.
- Each government should ensure the operation of a reporting and recording system for petroleum accidents, in cooperation with the oil companies.
- The governments are responsible for ensuring safe road conditions, and should fulfill their responsibilities.
- The governments should work with the oil companies to ensure a more efficient and effective petroleum sector. They should take advantage of regional associations.

Role of Companies

- Companies need to become good corporate citizens. They should take the lead in defining ways to improve safety, including public education on petroleum safety issues. They should take responsibility for the operational aspects of the industry through (a) accepting moral responsibility for the actions of their own staff and contractors and (b) arranging ways of getting the message across to public communities. At a practical level the measures should include operating an accreditation scheme for transporters, using well-defined specifications.
- In addition, because the companies are best equipped to handle operational matters, they should work with the national governments to (a) help ensure that operational experience is brought to bear when formulating the rules and regulations and (b) undertake the operational aspects of petroleum safety. Because national and regional cooperation will be essential to achieving these goals, the companies should form national and regional associations.

4

Options for Transporting Petroleum Products

Executive Summary

4.1 Consumption of petroleum products in SSA is relatively low compared to consumption in Europe, Asia, or Latin America. For this reason, the economic viability of establishing efficient bulk transport facilities in many of the region's countries has been unattractive, particularly for the private sector. With few exceptions, these countries currently use poorly maintained roads for petroleum product transportation. This practice incurs high inland transportation costs that are reflected in higher product prices, putting petroleum products beyond the reach of poorer sections of the society. Existing rail transportation facilities are badly managed, badly maintained, and unreliable. There are a few river/lake transportation systems operating, but all require modernization and improved management if they are to become reliable and cost-effective to consumers. For the same reason, all pipeline systems in operation, with the possible exception of the Durban-Johannesburg pipeline, also require modernization and improved management.

4.2 Under these circumstances, it is important to:

- a. Examine alternative modes of transportation (if appropriate, grouping the requirements of different sets of countries on a regional basis to improve efficiency)
- b. Rationalize existing modes of transport
- c. Minimize the cost of inland transportation.

4.3 The remainder of this chapter outlines the basis for comparing petroleum transportation costs and suggests (a) ways to establish reasonable pipeline tariffs and (b) steps required to rationalize petroleum transport modes on a regional basis under an effective regulatory framework.

Background

4.4 The traditional methods for inland bulk transportation of petroleum products involve the use of road tankers, rail tank wagons, pipelines, and petroleum barges on rivers and

lakes. For transporting relatively small volumes less than 300 kilometers, road tankers are the most cost-effective method, even though their unit cost (ton/kilometer) is the highest among all the above-mentioned methods. Beyond 300 kilometers, in volumes good enough for full dedicated trains, rail tank wagons could be the best solution, provided there is an existing system and that it is efficiently managed. When the railway is competently operated, the ton/kilometer cost of using a rail tank wagon is roughly one-half the ton/kilometer cost of using a road tanker. Transportation via pipelines and barges require relatively large initial investments, and generally are attractive only for large volumes traveling long distances. However, once the initial investment costs are amortized, pipeline and barge transportation offer the cheapest ton/kilometer costs in the long term because the basic operating cost for the pipeline, without amortization costs, is less than one-half the rail operating cost. The basic operating cost of petroleum barges, depending on the volume transported, could be cheaper than the pipeline operating cost. The relative advantages of each transport mode in the Sub-Saharan African context are evaluated later in this chapter.

4.5 Consumption of petroleum products in SSA is relatively low, ranging from a few thousand tons per year up to 1.0 million tons per year. (A few exceptions—i.e., those consuming more than 1.0 million tons per year—are Côte d’Ivoire, Kenya, Nigeria, and South Africa.) For this reason, the economic viability for establishing efficient bulk transport facilities in many of these countries has been unattractive, particularly to the private sector. As a result, these countries mainly use road transportation to move petroleum products, incurring very high costs in the process. Extremely bad road conditions decrease vehicle life span and increase the cost of transportation further. This unsatisfactory situation is very evident in the current transportation cost of petroleum products in countries such as Burkina Faso, Central African Republic, Chad, Mali, and Niger in Western Africa; Burundi, Malawi, Rwanda, and Uganda in central Africa; and Eastern Congo (Kinshasa) and Ethiopia in Eastern Africa, to name just a few.

4.6 Few petroleum product pipelines exist in SSA. Nigeria has the largest pipeline network, but it requires considerable upgrading. The same can generally be said of the Mombasa-Nairobi-Eldoret/Kisumu product line, the Biera-Mutare-Harare product line, the Matadi-Kinshasa product line, and the Dar Es Salaam-Ndola crude oil pipeline. Except to some extent in South Africa, inefficient management and a monopolistic approach to fixing the pipeline tariff have greatly reduced the advantage to the consumer of pipeline transport.

- 4.7 Petroleum product movement by barges in Africa is restricted to a few facilities:
- a. 100 kilometers of river navigation from Banana to Matadi in Congo
 - b. 350 kilometers of barge transportation from Akosombo to Buiepe in Lake Volta in Ghana
 - c. 450 kilometers of barge transportation in Lake Malawi from the Tanzania coast to Blantyre
 - d. 300 kilometers of barge transportation in Lake Tanganyika, from Kigoma in Tanzania to Bujumbura in Burundi and Uvira in Congo
 - e. 300 kilometers of barge transportation in Lake Victoria, from Mwanza in Tanzania to Uganda and between the ports in Tanzania and Kenya.

4.8 Except in the case of the 100-kilometer river transport in Congo, the full potential of the other systems is not being realized due to management inefficiencies and lack of direction among policymakers and of coordination among the various interested parties. The three-lake transport systems in Lakes Victoria, Tanganyika, and Malawi, with improved port facilities and suitable policies to attract private investment in petroleum barges, could provide the cheapest mode of transport for such landlocked countries as Burundi, Eastern Congo, Malawi, Rwanda, Uganda, and Western Tanzania. These lake facilities are already linked to existing rail and pipeline terminals.

The Need to Examine Alternatives

4.9 In a scenario in which petroleum consumption is low (as compared to Europe, Asia, and Latin America), infrastructure for import and storage and handling is inadequate, and several consuming areas are landlocked and thousands of kilometers away from a harbor, it is essential to evaluate carefully existing facilities and alternatives for petroleum bulk transportation. There are a few cases where existing facilities could be modified for greater use by several countries, provided policy decisions are based on least-cost options and regional development for mutual commercial advantage. Although beyond the scope of this paper, it would be worthwhile to carry out a country-by-country analysis, within a regional concept, to (a) rationalize the use of existing facilities, (b) plan required modifications/additions based on such analysis, and (c) plan future bulk transportation requirements on the same regional basis. The ultimate objectives should be to create a reliable supply network and to reduce the delivered cost of petroleum products as much as possible in each country. This should be one of the issues to be followed up by the countries concerned.

4.10 The high transport cost for petroleum products in SSA is mainly attributable to low volumes, high-cost road transportation, inefficient rail and lake transportation, and monopolistic tariffs levied by existing pipeline companies. For example, Table 1 shows the high transport cost for diesel fuel levied in 1998 in some of the landlocked areas (where pipeline or rail facilities exist) as compared to the cost in Western Europe.

Table 1: Transport Costs for Diesel Fuel in Western Europe and Landlocked Areas of Sub-Saharan Africa (US\$/MT)

	<i>Western Europe</i>	<i>Southern Angola</i>	<i>Zambia</i>	<i>Western Zimbabwe</i>	<i>Botswana</i>	<i>Northeast S. Africa</i>
CIF Sea Port	148.50	146.50	148.50	149.50	149.50	131.50
Inland Transport Cost	15.00	70.00	64.00	54.00	47.00	25.00
Total*	163.50	216.50	212.50	203.50	196.50	156.50

* Local costs—such as marketing and dealer margins and government taxes and levies—are not included.
Source: consultant calculation.

Rationalizing Petroleum Transport

4.11 Transporting petroleum products by road incurs the highest unit costs, especially in countries where properly maintained highways are not available (i.e., the only routes are country roads and tracks without an asphalt surface). For most short journeys, however, road transportation is the cheapest means. The governments need take no special actions to lower road

transport costs other than determining and enforcing safety and environmental standards and ensuring that roads are constructed to the right strength and are well maintained. However, to achieve broader transport economies, the governments should ensure that the petroleum companies have the incentive to seek lower-cost means of transport where available.

4.12 Railway systems, if operated efficiently, are cost-effective for transporting petroleum products more than 300 kilometers, especially where road conditions are not satisfactory. However, in SSA, all rail facilities are state-owned and -managed. Except partially in the case of South Africa, management is neither efficient nor cost-effective, with the result almost all the rail systems are maintained poorly and suffer heavy financial losses. Typically, the rail management behaves like a monopoly and refuses to accept performance liability. In general, there is a shortage of locomotives and rail tank wagons, very often caused by inefficient utilization of wagons. Due to poor maintenance of the rail track, train speeds have to be controlled, sometimes below 15 kilometers per hour. For these reasons, most of the rail systems will not be suitable for petroleum transportation unless major changes are effected in operation, maintenance, and management. Suggested remedial measures include the following:

- a. Transfer of management to experienced, profit-motivated operators with specific performance guarantees
- b. Movement of products in dedicated full trains (to improve tank wagon turnover)
- c. Installation of full train loading and unloading facilities at all locations
- d. Transportation under well-defined contracts of affreightment, including provisions for liability (many railways currently operate without contracts).

4.13 Petroleum transport by pipeline is limited to a few cases in SSA, mainly due to small market size in most of the region (see Figure 1). Even though the existing pipelines are generally the least-cost option as compared to road and rail facilities, improving efficiency would increase reliability and capacity utilization and reduce the delivered cost of petroleum products. In some instances, the pipeline companies tend to operate as monopolies, reducing the advantage to the consumer of having a pipeline. Profit-motivated management—with specific performance guarantees under a practical regulatory framework, as in the case of a public utility—is suggested to improve the operational efficiency of such pipelines and manage the tariff under reasonable limits. Wherever opportunities exist, countries should consider combining the use of existing non-road facilities in neighboring countries on a regional basis, creating a regional network that will benefit all concerned. For example, in Eastern Africa, the existing pipeline terminal at Kisumu (Kenya) could be used to supply, at the least cost, landlocked areas such as Northern Tanzania, Uganda, Rwanda, Burundi, and Eastern Congo through Lake Victoria and, if economically viable, by extension of the pipeline from Eldoret to the Congo border.

4.14 Barge transportation of petroleum products is already used in a number of situations (see paragraph 2.4). The main need is to improve, extend, and broaden the present operations—in other words, to (a) improve efficiency, reliability, safety and environmental protection; (b) extend range in terms of additional river or lake ports; and (c) to broaden access by introducing competition. When efficiently operated, river and lake transportation can be the cheapest mode. The priority is to foster a commercially-oriented management style that can operate at close to Western standards. Given the current government-oriented operations, this is no small challenge.

Comparison of Petroleum Transport Costs

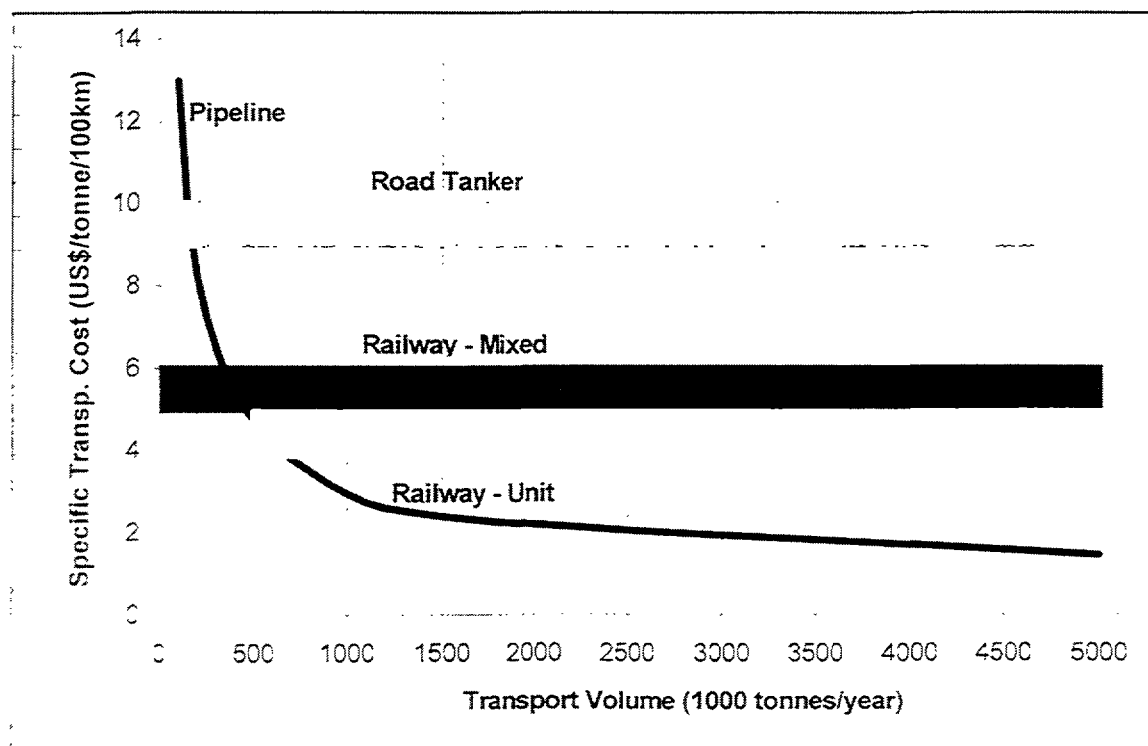
4.15 There are two methods of comparing the cost of different modes of petroleum transportation. In the first method, the specific transportation cost of different modes is compared by dividing the cumulative present value of the investment and operating cost by the cumulative present value of the throughput for a certain period of time (normally 20 years) and at a discount factor (say, 12 percent) for a unit transportation distance of 100 kilometers in each case. In the second method, the specific transportation cost of different modes is compared by dividing the sum of annual capital expenses and annual operating expenses, referred to a transportation distance of 100 kilometers, by annual throughput. The annual capital cost expenses can be derived from the investment, assuming an amortization time of, say, 20 years and a reasonable interest rate, using the following formula:

$$K = I((i(1+i)^n) / (1+i)^n - 1)$$

where K is annual capital cost expenses, I is investment cost, i is interest rate, and n is amortization time.

4.16 Figure 2 compares typical petroleum transportation costs for various levels of throughput for road, rail, and pipeline modes. As the graph shows, the specific transportation cost via pipeline decreases with increasing transport volume, whereas product transport by road or railway are not dependent on the transport volume. Figure 2 also shows that the pipeline option becomes competitive once transport volumes rise above 700,000 tonnes per year and that, with a transport volume of three million tons per annum, the specific transportation cost of using a pipeline is about one-fourth the transport cost of using a road tanker.

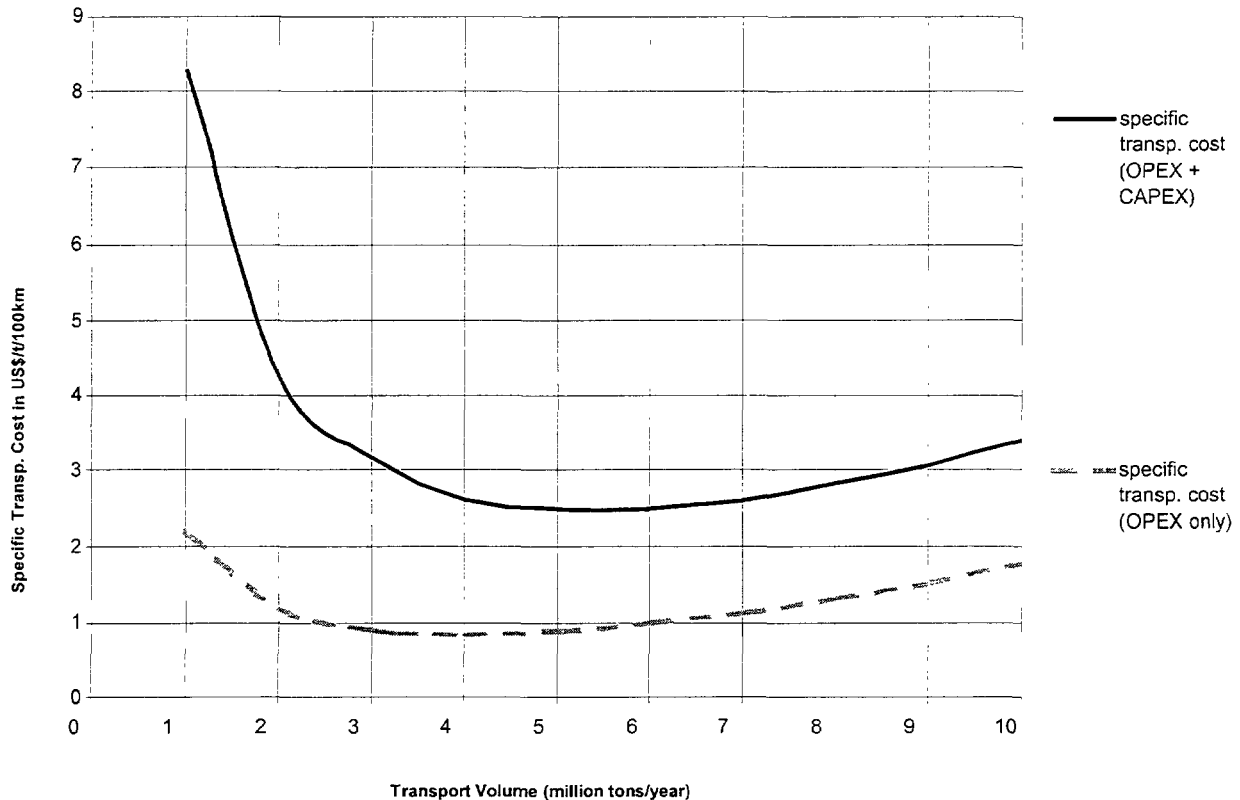
Figure 2: Comparison of Typical Petroleum Transportation Costs



Note: these are economic costs: no margin for profit has been added

4.17 For the pipeline, amortization of initial capital expenditure has a major influence in determining tariff. Once the debt repayment and capital cost depreciation is completed, the pipeline tariff should be recalculated to achieve the competitive edge. Figure 3 shows the specific transportation cost (before and after amortization of capital cost) for a pipeline 12 inches in diameter. The comparison demonstrates that even if the cost of preventive maintenance increases, the specific transportation cost decreases by about 50 percent as compared to the cost during the amortization period.

Figure 3. Influence of Amortization for a 12-Inch Pipeline



Regulation of Transportation Tariffs

4.18 Groups of countries should join together to plan an efficient regional mode of transportation, such as a pipeline, that will be advantageous to all in reducing the delivered cost of petroleum products. In order to operate such a common pipeline and obtain the anticipated favorable economic results, a workable regulatory framework, including basis for determining tariff structure, should be in place. Following are a few suggestions:

- a. The tariff formula should allow for cost recovery and a reasonable return on investments.
- b. The basis for return on investment should be comparable with other efficient facilities in neighboring countries, if any.

- c. Cost comparisons should account for the commercial and political risk factors involved, if any.
- d. There should be suitable provision to adjust tariffs in line with varying inflation rates in different countries for multi-country pipelines.
- e. There should be incentives to provide services efficiently at the lowest cost, instead of passing on all costs to the consumer.
- f. Industry members should be involved in tariff discussions.

Rationalization of Petroleum Transport Sector

4.19 In order to rationalize the petroleum transport modes and prepare an action plan, the following basic ground rules are suggested:

- a. Compare existing actual transportation costs with benchmark cost to identify the potential for improving efficiency and reducing costs.
- b. Evaluate the transportation element in the delivered cost of petroleum products, compare it with costs in neighboring countries, and explore regional transport options that will reduce cost.
- c. Prepare an action plan to improve the efficiency of the existing system and/or change the transportation mode on a regional basis, if viable opportunities exist.
- d. Identify markets where supply by barge can be economically attractive and environmentally sound, provided that traditional inefficiencies can be overcome.
- e. Identify regions consuming one million tons per year or more, and explore options for installing product pipeline systems to service all of that region's countries.
- f. Explore options for inducing the private sector to provide the initial investment and technical and managerial skill to construct, operate, and maintain the pipeline and related inland waterborne-transport facilities on behalf of all the countries concerned.
- g. Prepare the regulatory framework under which the facilities will be owned and operated; the optimum level of tariff will be modified as needed, and efficient service will be provided to all the countries on an equal-access basis.

5

Promoting Regional LPG Trade

Executive Summary

5.1 Commercial energy is generally expensive and thus remains out of reach of most households in SSA. Wood fuel is the main source of energy, even though in many areas, especially in the arid and semi-arid regions, its use is causing massive deforestation. Among the major environmentally clean commercial fuels, electricity is in short supply and is not expected to reach many households due to its relatively high cost and the initial expenses involved in the purchase of electrical appliances. Where available at a reasonable price, liquefied petroleum gas (LPG) is the fuel of choice. It is environmentally clean and should be cost-effective and competitive for domestic uses due to its versatility and increased availability in the region.

5.2 Unmet LPG demand in SSA is currently attributable to supply constraints and the extremely high cost of imports. In recent years several off-shore oil fields in West Africa have developed facilities to extract about 500,000 tons per year of LPG from associated gas, which otherwise would be flared. LPG's delivered cost could be reduced to a competitive and affordable level if a few focal points could be developed as import "hubs" on a sub-regional basis by (a) improving storage and handling facilities, (b) organizing efficient distribution from these hubs, and (c) modernizing the distribution and marketing infrastructure as appropriate. Using suitable marketing techniques and incentives to phase the payment of initial costs can make LPG affordable to low income households.

5.3 In order to achieve this, the following are essential:

- a. Institutional reforms
- b. The establishment of an appropriate regulatory framework
- c. The removal of excessive controls on LPG pricing
- d. An even-handed and low tax structure on LPG and competing fuels
- e. Fair and equal access to the facilities at the hubs for all operators.

5.4 This chapter discusses ways to achieve these objectives at the least cost to the end consumer, while still making the various business opportunities attractive to investors.

Commercial Energy: A Tiny Slice of Total Energy Demand

5.5 In SSA commercial energy remains out of reach of most households. Fewer than 8 percent of households have access to electricity.⁴ Where commercial energy is available, moreover, it is usually expensive, the quality of service is often poor, and the electricity often needs to be supplemented by traditional energy sources because of the imbalance between supply and demand.

5.6 In the residential sector, biomass is still the mainstay of food preparation and water heating. Estimates by the International Energy Agency in 16 SSA countries show that commercial energy (oil products and electricity) represents a mere 3 percent of the total energy used by households, while the balance is met by biomass. Although biomass presents some comparative advantages vis-à-vis commercial energy (e.g., good availability, retail price, and purchase flexibility), it is less efficient (measured in useful energy) and puts increasing strain on remaining woodlands. In most countries, deforestation is proceeding at a very quick pace, while reforestation remains shy of reasonable targets. The Bank estimates that since 1980 SSA has lost close to 15 percent of its forest area (up to 25 percent in some countries along the Gulf of Guinea seaboard), and woodlands account for no more than 26 percent of the region's land area.⁵

5.7 Though wood fuel demand is not the only factor responsible for wood-cutting (the lumber industry and the search for more agricultural land also take a heavy toll), increasing the share of commercial energy will help alleviate deforestation, in particular in Sahelian areas and around larger cities. Making commercial fuels readily available will also curb the cost of household energy, because it will reduce the demand pressures and supply constraints on wood fuels. The price of fuelwood and charcoal, in particular in Africa's larger cities, is steadily increasing in part due to higher transportation costs as production sites get ever farther from consumption centers. Although electricity tariffs, in addition to the cost of electric appliances, are likely to keep electric cooking out of reach of a large majority of households, the high versatility, convenience, and increased availability of LPG should in the near future make it the preferred fuel for domestic uses.

Distorted LPG Demand and Supply Patterns

5.8 At 510,000 tons in 1997, LPG consumption in the residential sector of SSA remains well below the corresponding figure of other developing regions. With a few exceptions,⁶ yearly per capita demand in most SSA countries ranges between 0.5 and 2 kilograms, the average consumption being about 0.9 kg, which remains low when compared to lower and middle income sub-regions in Asia, South America and North Africa (see Table 2).

⁴ This figure is based on actual connections in 13 countries in southern and central Africa; South Africa is not included. Source: Eskom yearly activity report.

⁵ Extrapolation from *World Development Indicators* (World Bank, 1997).

⁶ For example, Senegal (8.8 kilograms) and Gabon (14.5 kilograms).

Table 2. LPG Demand in the Residential Sector in Selected Emerging Economies

<i>Region</i>	<i>Yearly demand (000 tons)</i>	<i>Population (million)</i>	<i>GDP per capita (US\$)</i>	<i>Demand per capita (kg)</i>	<i>Demand per US\$1,000 GDP (kg)</i>
Sub-Saharan Africa	510	593	515	0.9	1.7
Low-Income South Asia	4,580	1,060	397	4.3	10.9
Middle-Income East Asia	3,685	340	1,746	10.8	6.2
Middle-Income Latin America	1,771	80	2,155	22.1	10.3
North Africa	4,082	121	1,398	33.7	24.1

Source: LPG: MCH through World LPG Association (WLPGA) (1997); GDP and population: World Bank (1996).

5.9 Limited LPG consumption in SSA is often attributed to the population's low income level. Although it is obvious that low income levels limit access to most goods and services, including LPG, facts show that supply constraints, inadequate institutional framework (including pricing and subsidies), and lack of incentives for marketers—not income level—are by far the major hindrances to LPG consumption. A clear illustration of the upside potential is the case of Côte d'Ivoire, where the introduction in 1994 of a new entrant developed the potential market well beyond the existing level of consumption, while LPG sales by traditional marketers remained unchanged (see Box 1). It is quite likely that the conditions in other cities in SSA resemble those prevailing in Abidjan.

Box 1. The Case of Côte d'Ivoire

When state-owned Petroci entered the LPG business in 1994, it actually developed its own market without harming competition. Although sales by existing marketers remained globally unchanged at their stable, long-standing level of 20,000 tons per year or so, Petroci actually created a new market within the untapped, albeit solvent, potential market by supplying a market segment not previously being supplied. In just three years, total national sales had increased by 60 percent. This shows the following:

- Marketers sell whatever quantity is available; they are constrained (in part) by supply, not by demand.
- Private sector marketers do not actively develop their activities as long as it is not profitable. In Cote d'Ivoire, the LPG price did not provide the operators with a positive operating margin until the recent price adjustment, thus leaving the private marketers' activity coasting without new investment; aging inventory of cylinders create strong concerns about safety.
- Upside potential is important and not constrained by income (LPG prices are regulated and Petroci's rates are similar to that of other marketers).
- New markets are still to be tapped. Although Petroci sells the traditional, 12-kg cylinder market, its newly developed promising markets are the 6-kg cylinders intended for lower income households (which is the leading market in Senegal as well) and the 45-kg cylinder dedicated to small businesses, with particular emphasis on the "maquis," i.e., the open, sidewalk restaurants to be found in hundreds in Abidjan's industrial and populous areas. It is likely that these markets can be expanded further.

5.10 The LPG market in SSA is actually determined by cost/supply rather than demand constraints. This has been a long-standing issue. In those countries where a refinery operates, it generally is the only source of domestic supply; production is limited by the refinery's size and technical LPG output ratio, which depends on its design and the quality of crude oil processed. Production is also constrained by the refinery configuration: many refineries fail to maximize LPG recovery. LPG output from refineries has proved largely insufficient to meet growing demand, while landlocked countries and those without a refinery (i.e., the majority) can only rely on limited imports from neighboring countries through inadequate, costly transportation and storage facilities.

5.11 LPG imports have often been constrained by high import prices, the refinery's official or *de facto* monopoly and/or protection, limited receiving storage facilities, and insufficiently competitive procurement and transit procedures. As a result, only 5 percent of the LPG consumed in SSA is supplied through international trade, well below the corresponding figures for South America (21 percent) and Asia (50 percent).

5.12 In the near future, however, availability of LPG from regional sources will no longer remain an issue. A recent study⁷ projects that offshore gas production in Western and Eastern Africa is expected to soar from 5 bcm in 1997 to 12 bcm in 2000, a 140 percent increase in just three years, and ten times the 14 percent increase projected for the activity worldwide. Incremental LPG stripped from wet gas streams⁸ should thus supplement in increasing proportion the LPG output extracted from associated gas in oil fields.⁹ In addition, a large number of oil and gas fields remain unexploited¹⁰ in almost every oil country across SSA. Regional aggregate output in the Gulf of Guinea area from facilities completed or near completion is expected to reach 500,000 tons by the end of 1998.

Institutional Issues

5.13 Lifting supply constraints at the production level must be accompanied by parallel measures aiming at facilitating LPG trade throughout the region. Experience shows that (technical) supply bottlenecks are often compounded by institutional issues. Where the institutional framework is inadequate, i.e. the organization and regulations of the industry, adequate incentives for the operators are unlikely to develop resulting in a lack of investment in essential infrastructure (receiving terminals, storage, bottling, and distribution facilities).

5.14 With regard the organization of the industry, LPG operation is generally carried out (but for a few exceptions), by private entities. However, bottlenecks do remain, often due to exclusive rights held by some operators such as refineries or bulk storage operators, translating into unfair conditions in accessing markets and often preventing competition from developing.

⁷ Mackay Consultants, May 1998.

⁸ For example, at Panthere, Côte d'Ivoire.

⁹ For example, N'kossa, Congo; Lion, Côte d'Ivoire; and Alba, Equatorial Guinea.

¹⁰ For example, in Angola, Cameroon, Congo, Equatorial Guinea, Nigeria, and Senegal.

Pricing Issues

5.15 Bulk prices (ex-refinery or import prices) of LPG are often far in excess of the prices needed if cost savings are achieved. As a consequence, they distort end-user prices. They generally consist of high ex-refinery prices, based on Mediterranean prices for small spot cargoes, coupled with expensive freight established on the basis of small ships. They typically range from US\$170 up to US\$800 per ton. Although such pricing formulae were appropriate, from an economic standpoint, in a scarce supply environment where the alternative to local supply was to import LPG from Europe or the Gulf, they are becoming out of line in a situation where local supply is becoming abundant—which is increasingly the case in the Gulf of Guinea sub-region. Bulk LPG prices should soon fall substantially.

5.16 Because of its high political sensitivity and limited supply, LPG pricing is generally established and controlled by governments. Although prices may have to be regulated as long as major structural dysfunctions remain, operating margins must be attractive enough to allow operators to invest in and develop their activities. Once supply is no longer constrained and the organization of the industry is sound, price regulation is no longer required. With improved unloading berths and storage and handling facilities in the sub-regional hubs, larger parcels of LPG can be imported to reduce the unit cost of distribution and marketing infrastructure, and delivered prices to households can be further reduced.

5.17 One of the most significant problems is for the customer to meet the cost of the LPG bottles and appliances. Marketers should address this (possibly with government support) by helping with phased payment of the initial installation costs. LPG sales would thus be made affordable to low-income households. Our view is that subsidies are rarely appropriate (see Box 2).

Box 2. Are Subsidies an Option?

Over the long term, end-user prices must reflect the actual economic cost of the product. Subsidies may have helped develop the market initially (in Senegal, for example), but must be approached with extreme caution. Experience shows the following:

- In many countries, LPG consumption has remained idle in spite of subsidies, because supply constraints and limited competition, not weak demand, are the key issues;
- Where subsidization was significant, the subsidies created a heavy burden on the State's budget that increased as LPG demand developed;
- In some cases, governments have tried to recover part of the subsidies by reducing operators' margins, thus hampering industry development and creating shortages;
- Without reducing bulk import cost through improved infrastructure and pricing structure, removing subsidies by going to import parity pricing often presents a certain political risk;
- Although they are intended to help the poor, subsidies often miss the assigned target and do not help to allocate public money efficiently;
- Subsidies develop smuggling, which actually benefits consumers in neighboring countries rather than domestic consumers in the country giving the subsidies;
- Subsidies are counter-productive in that they tend to create scarcity, which in turn translates into black market, smuggling, thus higher actual prices.

Developing Hubs to Increase Supply at Lower Cost

5.18 At the local level, present and potential LPG demand exceeds the capacity of existing refineries and local LPG-stripping plants. Thus, additional supply will have to be provided through international and regional trade. In addition to the larger, higher-consumption countries located along the seaboard, lower-consumption countries (as well as landlocked countries and markets with no direct access to bulk supply) require efficient, well-equipped intermediate levels of supply (i.e., storage and transportation) to keep costs as low as possible.

5.19 The economic cost of the LPG chain is very sensitive to the size of operation. Significant savings along the whole chain can be achieved through economies of scale by pooling the requirements of neighboring countries and increasing the size of terminal and bulk storage facilities at suitable locations, thus allowing larger LPG cargoes to be delivered where LPG is imported, stored, or traded. In turn, increasing the throughput reduces the unit cost of storage and handling and enables marketers to modernize bottling plants and streamline marketing and distribution. Currently, for importing 500–1000 MT LPG parcels in West Africa, ocean transport suppliers charge about US\$180 per MT. If the parcel size is increased to 2,500 MT, the cost comes down to about US\$65 per MT, a saving of about US\$115 per MT. In the future, when the supply originates from West Africa offshore platforms, this difference will be about US\$45 per MT. Existing import terminals in Dakar and Abidjan would be able to handle the larger LPG parcel size with minor investments. Building the facilities required to handle 2500-MT parcels at a new terminal would cost about US\$15 million. If the new terminal handles a capacity of about 150,000 MT annually, the investment will be paid back in about two years.

5.20 Establishing such common carrier import terminals (hubs) implies some basic pre-requisites. Each hub must enjoy good land/sea connections (spokes) to downstream markets, with easy access, reliable operation, and low costs. In addition, the hub must operate in a sound institutional environment. *Having natural monopoly qualities (more than one hub in a single country is unlikely), the hub must be operated under a concession of regulated monopoly.* It should be operated as a common carrier by an independent company, its facilities open to all operators to allow for promoting competition at downstream levels of the LPG chain (transportation, secondary storage, bottle filling, and distribution). Open access implies that fees will be charged on a non-discriminatory basis to users with similar patterns. A good cooperative environment with neighboring countries is required to facilitate imports/re-exports, with particular emphasis on an efficient bureaucracy (namely, customs) to speed up cross-border trade.

Towards a New Regional Market

5.21 Developing hubs at suitable locations for countries joining together to cooperate in receiving, storing, and handling cargo sizes of 2,500 to 3,000 tons would help to reduce freight rates from Mediterranean ports to the Gulf of Guinea to less than US\$100/ton.

5.22 With the commissioning of new LPG production facilities linked to the development of gas (whether associated or not) in the region, local markets in Western Africa will benefit from competition in a surplus product scenario. First, LPG at production sites should be available at lower FOB prices, based on the CIF price on traditional markets, such as Brazil, or at major hubs (Mediterranean, Gulf, Caribbean) minus ocean freight. Second, the proximity of regional hubs to production facilities should keep regional freight rates at more reasonable levels—as low as US\$30–50/ton where modern receiving and storage facilities allow the use of larger LPG tankers. As a result, development of this new regional market would enable the countries in the region to reduce the delivered cost of LPG (at end users) very significantly.

Conclusion

5.23 The LPG market in SSA is at a turning point: the aspirations of millions of Africans can be met from increased regional supply sources in a cost-effective manner, provided that:

- Countries collaborate on development of LPG hubs based on the regional market potential;
- Countries maintain fair and open access to hubs by ensuring that receiving, bulk storage, handling, and dispatch facilities are made available to all operators without undue discrimination (this equal access will probably have to be agreed on contractually before the hubs are built);
- The main countries develop a non-political regulatory system covering, inter alia, LPG, to promote competition and fair behavior, and to monitor the market (this should also ensure non-discrimination towards other countries dependent on these hubs);
- Price regulation is progressively lifted as supply constraints fade and fair competitive procedures govern the access of the operators to the market, although

a reasonable price regulation may still be required until market can be fully opened;

- Operators are given incentives to develop their activities, in particular through rational price structures based on real economic costs; and
- Any remaining subsidies are removed as quickly as possible.

5.24 In collaboration with world Liquefied Petroleum Gas Association, the World Bank intends to conduct a special study on LPG use in low-income households to identify the infrastructure, policies, and incentives required to make an environmentally friendly fuel such as LPG available for domestic use in low-income households at an affordable price. The results of this study will be presented in the next petroleum workshop for discussion and preparation of an action plan.

6

Petroleum Product Regulation and Pricing

Executive Summary

6.1 Few African countries in Sub-Saharan Africa have reformed their petroleum product sectors. The operations are frequently inefficient, expensive, confused, unreliable, and an example of how not to do things. Although the trucking of goods and farm produce is crucial to the livelihoods of urban and rural people alike, few politicians are willing to face up to the special interest groups that, through interference with the fuel supply system, prevent this from happening. Supply in rural areas is often irregular, and in many cases the petroleum suppliers would pull out if they could find someone to buy them out at a price that broadly covered the investment previously made. At the other end of the spectrum, in reformed countries (Mozambique being the best example), there are new investments, a reliable supply, new entrants to the market, and an environment where pricing is depoliticized. This latter situation does not necessarily need higher prices; it just needs removing of pointless bureaucracy.

6.2 A World Bank study carried out in the early 1990s estimated the annual inefficiencies in the downstream part of the African petroleum sector to be equal to the International Development Agency's (IDA) annual support for Africa—that is, in excess of US\$1 billion. Most of this could be saved through changes in policies rather than through new investments. Non-competitive petroleum procurement is an obvious case, with little competition in the national supply and import costs that are quite “fat.” Some governments go out of their way to find reasons to discredit the most competitive suppliers. Banks providing letters of credit charge a magnitude more in Africa than they do in middle-income and rich countries. Product specifications are often a hang-over from the colonial era, and the standards used are sometimes not only irrelevant but result in these non-standard specification products being supplied at a premium price. In the refining sector, most of the continent's refineries are not designed for the modern era and cannot compete on price or quality with international suppliers. Transport of petroleum products is unreliable (theft and stockouts are both common) and much more costly than in most developed countries.

6.3 No regulatory systems in Africa are independent of political influence. Ninety percent of African countries still set petroleum prices politically, and ninety percent of these do so badly. In some countries national oil companies manage the price system, and take a large

slice of the price for themselves, even though their operational role may be minimal. Often the retail prices do not fully cover import costs; there are subsidies and cross-subsidies. In some countries even the efficient companies are near bankruptcy. Other countries have frozen the margins for many years, and complain about lack of competition.

6.4 In this situation the objective should be reform and continued implementation of policies designed to make the petroleum supply reliable, efficient, transparent, and cost-competitive. The opportunity should be seized whereby countries can reinvigorate development through minimizing the real cost of fuels, ensuring that they are available as needed. The opening up of the sector to normal economic behavior through real competition is the goal to strive for, with the government focusing on frameworks and structures for policymaking and monitoring that stimulate competition and lower the barriers to entry. They should regulate only where market imperfections make it necessary, otherwise minimizing their involvement on the business end.

Potential Benefits of Liberalization

6.5 The ills of the politically controlled systems include:

- a. High import costs;
- b. The government's need to manage the foreign exchange for the imports and strategic stocks;
- c. Stockouts, nationally and locally, running stocks down to conserve cash;
- d. Low investment levels, leading to ancient facilities;
- e. Directed supplies to non-payers;
- f. Financial difficulties among operators and the problems (e.g., poor cash flow, low investment, non-payment for supplies, non-payment of taxes) that result from this;
- g. Lack of professionalism across the board;
- h. Optimization against the regulations (including cheating) rather than optimization of commercial behavior; and
- i. Monopolies, lack of choice, and inefficiencies stemming from lack of competition.

Some of the more extreme cases include monopolistic refineries that only supply their shareholder companies, and subsidies on certain products equal to 100 percent of the import price.

6.6 Liberalization has become normal in most OECD countries. In these countries the government sets the regulations and monitors compliance, but almost all of the operations are undertaken by the private sector. Costs and prices (net of tax) are lower than in most less-developed countries when the impact of subsidies is excluded, mainly because operations not suffering from political involvement can be much more focused on the market. The industry works essentially like other large industries, without particular political sensitivity or special "rules of the game." Price control is no longer the norm. The distributors are able to be financially viable, they invest, they compete. Except in the most special situations, supplies are reliable. The companies take the full responsibility for supplies; there is no opportunity to blame

someone else. For the consumer, buying petroleum is almost like buying groceries. These benefits can be achieved in Sub-Saharan Africa if the political will is there.

Application of Liberalization to Small Economies

6.7 Liberalization of the petroleum sector can work in the developing economies of SSA. In the small markets there may need to be special institutional arrangements to deal with problems caused by lack of size and by the reduced scale of competition. There are, however, good examples of success (Mali, Mozambique, Kenya) in simulating a competitive environment, and these should be used to ensure clear benefits for the people as well as for the national finances.

6.8 Liberalization needs low barriers to entry, and many of the problems of ensuring low barriers to entry relate to access to product. In large markets the distributors can afford to duplicate facilities because the market is big enough to justify multiple tanks and pipelines, but this does not apply to the markets found in most developing nations. A country with its own refinery can ensure access by permitting all licensed distributors to take product from the refinery on equal terms, regardless of the refinery ownership arrangements. (In the “how not to” examples there are refineries that only supply product to their shareholders). In some cases, access to the refinery will need to be legislated. Countries with no refinery, or with restricted access to a neighbor’s refinery, will import product. For these the question of scale in the imports is crucial. For new distributors to compete, they will need reliable access to product at essentially the same price as the existing distributors. Depending on land availability and costs, this may mean that non-discriminatory access to import pipelines and storage must be made obligatory. It may also mean that a system of import aggregation for at least some of the product (the example given being Mozambique) is required to ensure that all oil imports are in appropriately-sized vessels.

6.9 The “work horse” for transporting petroleum products is typically a 25,000-ton marine tanker. Even where harbors are capable of handling a bigger vessel, the markets are frequently too small to justify it. Smaller vessels are much more expensive, possibly several times as high in unit cost, and for most economies efforts should be made to combine the shipping into the standard size vessels. This question of cargo size is not simply a matter of vessels and related storage capacity, as stock turnover is essential for all products because of deterioration. Jet fuel is a particular constraint, and a target turnover of six weeks would be about as slow as would be comfortable. 25,000 tons delivered every six weeks corresponds to an annual level for white products¹¹ of 200,000 tons. Because one-half of the SSA markets are below this, it is clearly out of the question for a new distributor to start out at this level. The combining of imports is even more crucial for the smallest economies, to minimize the average shipping costs.

6.10 Access to product may need to be achieved by combining imports. One solution (Mozambique) is to achieve cost-efficiency by requiring all distributors to participate in an import cooperative, that is owned by all the distributors. An alternative (Tanzania) is for each local distributor to bid, every month to six weeks, to supply all of the next month’s national

¹¹ “White” products are gasoline, kerosene, and diesel. They are transported in “clean” vessels, and a storage hold may be used interchangeably for any of them. “Black” products are fuel oil and industrial diesel, which are “dirty” and require separate vessels, dedicated separate holds, or extensive cleaning of a vessel after use.

imports, with the winning bidder supplying all distributors. In either case all licensed distributors will have equal access to the product. Tanzania has a total demand of about 650,000 tons, and the scheme would work even if the largest distributor did not participate.

6.11 In principle, countries, not just enterprises, can join together to achieve critical mass in product imports. To date, however, successful examples are rare.

6.12 Once there is assured access to product, there are few guidelines on minimum market size without which competition is unlikely. There are many examples of profitable distributors with sales volumes of less than 20,000 tons per annum, particularly if the distributor does not seek to provide national coverage. Assuming that about five equally-sized companies would lead to adequate competition, this could lead to quite active competition in markets of 100,000 tons, particularly in the more compact countries of west Africa. There are examples of small markets with many more than five distributors, but this is not something that governments should be concerned about.

6.13 This discussion on market size ignores the distorting effect of really large customers such as power plants and mines. In fact, it may be in the overall interest to allow these large customers to import their own fuel—subject, of course, to the same requirements for combining imports, safety, and so on.

6.14 It is commonly said that firm price controls are needed in a particular country because in that country there are only two or three distributors and most small towns have only one filling station. But this is a self-fulfilling prophecy: the firm price controls will make sure that there is no competition. It is the uncertainties of arbitrary price controls that kill the incentive to invest. There is rarely a need to introduce regulations to prevent exploitation in low-demand areas of a country, provided there are no significant barriers to entry. Should profits get to a high level, competition will develop on its own.

Pricing Systems

Liberalization

6.15 The recommendation is to liberalize pricing to the extent possible. This is because few countries have the self-discipline to manage a system of price controls efficiently. In almost every case, the system breaks down when an election is due or when the results from the price adjustment are politically inconvenient. Hence the focus on ensuring access to product so that the marketing companies can behave like businesses and need not focus on outguessing the vagaries of the system.

Price Control

6.16 If governments for whatever reason decide that petroleum product prices are to be controlled, then a number of questions have to be addressed. Although these are political questions, they need to be based on the physical realities of the country.

6.17 *Should the pricing procedure be enacted into law?* Most pricing systems have failed because governments chose to ignore them. The result has been major financial traumas, principally for importers. The track record is mixed—there are examples of success both with

legislated and non-legislated systems—but there are many more examples of failure with the non-legislated systems where government can get away with ignoring the procedure.

6.18 *Who is to set the prices?* Some performances have been so poor that the oil companies have asked to be the operator of the price system. Where the import arrangements are efficient and transparent, as is the case with the joint import arrangements mentioned earlier, it would be reasonable for the industry jointly to manage the import part of the price, following well-defined rules, in what is essentially a mechanistic approach.

6.19 *How frequently are prices to be adjusted?* The prices need to be adjusted as frequently as is practicable. Even where the currency is stable, monthly adjustment, or cargo by cargo adjustment, is needed to ensure that large losses or gains on the import price component do not happen simply because international price movements are not translated quickly enough into local prices. Tax components need to be an immediate pass through, from whenever a tax change comes into effect. Similarly, if transport costs are nationally determined then the impact on petroleum prices would depend on the transport agreement. The maximum margins for the marketer and dealer need to be adjusted annually, and should be based on audited accounts for the marketers and sample costs for dealers, with the proviso that rapid currency adjustments or hyperinflation would lead to more frequent adjustments.

6.20 *Which prices are to be controlled? Which products? Which locations?* It is rarely advisable to set the maximum prices for all fuels. The most sensitive prices are those for kerosene, gas oil, and in some countries LPG. Many governments control the price of gasoline, yet in a developing country context this is normally not a fuel that needs special protection as most gasoline is purchased by businesses and rich individuals. Some countries control the maximum price of fuel oil, particularly for power generation. This seems to be unnecessary, if the power company can import direct then there should be no special pricing. Some countries try to set maximum prices for every town, others for the main centers only, and others insist on standard national prices. In most countries if maximum prices are set for two or three towns then most of the consumption is covered, and normally the attempts to set prices for every town are doomed because of insufficient reliable and timely information, and weak communication systems. In such a case the response of the industry is often to provide poor service to the areas where the prices are inadequate. As to standard national pricing, it leads to cheating, and to loss of economic efficiency.

6.21 *Which price elements are to be controlled? Are they to be based on actuals or on forecasts? And are they to be ceiling prices or fixed prices?* The price components that could be controlled are the import cost component (or ex-refinery price), the transport cost, the maximum distributor and dealer margins, and the overall “ceiling” price. Where there is a national refinery the ex-refinery prices would need to be fixed at import parity (or export-parity for surplus products), and if there is a need to subsidize the refinery then there could be a specific element in the price structure for refinery subsidy (subsidization of refineries is not recommended, but countries do it anyway). The import cost should be based on actuals, provided that these are based on efficient and competitive arm’s length prices. The distributor costs should be based on audited accounts. Dealer costs should be based on a sample, and should take into account the other trading activities at the dealer’s premises. There is no strong case for having different (per liter) margins for the main products, so it is easiest if an equal margin is applied for all main products.

6.22 *What tax objectives are relevant (e.g., protecting the poor, maximizing tax revenue from the rich, protecting the environment)?* Taxation of petroleum fuels is often high, and for social reasons varies from fuel to fuel with high taxes on fuels for the rich (gasoline) and low taxes on fuels for the poor. The international price of the main petroleum fuels (gasoline, kerosene, gas oil) are normally very close, but because of taxes this frequently is not the case at the retail level. However, the problem to watch for is that the taxation could lead to the wrong fuel being chosen with consequent inefficiencies and pollution impacts. This happens in two ways. Consciously, in some countries the rich buy diesel-engine cars, and many people buy diesel-engine light trucks, simply to avoid the high levels of tax on gasoline, not because of the merits of the fuel. Likewise, both kerosene and LPG are fuels for lighting and cooking, and unequal taxation can lead to one being preferred against the other for reasons unrelated to merit. The second way is perhaps even more serious, that it is possible to blend some of the lower-taxed fuels with higher-taxed fuels, and pass them off at the higher price. This leads to poor vehicle performance and to pollution. In respect to diesel engines being chosen, this can to some extent be dealt with through the tax on the vehicle itself. For the contamination of fuels, there are no sure solutions in any country, and it is better to try to avoid the distortions getting too great by keeping the tax levels fairly close.

Regulation

6.23 Every country needs a *regulator* to ensure that the petroleum products sector is competitively run. In some countries where there is active competition and no price regulation, the regulator is a *monopolies commission* that monitors all commercial sectors, and the aim should be to have a market system that is so competitive and self-policing that the role of the regulator is minimal. The regulatory system also covers an *inspectorate* that ensures accurate measurements and monitors compliance with health, safety and environmental regulation, very often as part of the other functions of government. Where the structure of the industry does not assist competition, or where as a matter of philosophy the government (unnecessarily) wishes to regulate prices, petroleum products should be covered by the regulatory system that applies to other regulated sectors.

6.24 Particular issues that the regulator will need to monitor include the import arrangements and the extent to which efficient arm's-length pricing is achieved for product imports, third party access arrangements, barriers to entry and exit, strategic stocks, reliability of supplies, and whether behavior is competitive.

6.25 Whichever system prevails, the key issue is for the regulator to be as independent as possible from the political system. His role and duties (e.g., promotion of competition, monitoring, price adjustment) need to be defined by statute, and there needs to be a clear definition of the *regulator* as opposed to the *policymaker* and a clear and transparent interface between regulator and politicians. There also needs to be a credible right to appeal decisions of the regulator. As part of this independence, the regulator should be appointed by the country's president and not by the sector minister, his tenure should go beyond the lifetime of one parliament, and procedures for his removal should be set out in the law. A role extending beyond one sector ministry adds to this independence. To the extent possible the budget of the regulator should be set by parliament or be funded by an independent levy, and should not come under a sector minister.

Future Work

6.26 This paper summarizes best practice based on a sample of the few countries in SSA that have made progress in reforming their petroleum sectors. Less than ten small African economies have liberalized prices. About the same number have a semi-successful price adjustment system. A handful of African countries have real competition. Most countries still have a long way to go in establishing an efficient sector.

6.27 Decisionmakers must appreciate the key step of separating conceptually the pooling or joining together on imports as opposed to competition in the market. A number of countries have experienced the benefits of combining their imports while maintaining competition in the market place; and although a few continue to benefit, for others the discipline of keeping the prices up to date became politically inconvenient and they now are facing the inevitable problems that result.

6.28 The ultimate measures of success or failure are reliability of supply, minimization of cost, safety, and viability of the suppliers, sustained over the long term. The most difficult to assess is the “appropriate” reward for investors, distributors, and retailers, and it will be important to understand this better and its to determine its impact on the other measures.

6.29 The next step is to research carefully the successes and failures, not to criticize the countries concerned but to identify what seems to work—to clarify the lessons learned and identify their benefits and costs. The immediate focus is on the issues of:

- a. Price liberalization, and the pitfalls and problems that can be avoided;
- b. Pricing mechanisms, and what is needed for them to work;
- c. “Acceptable” margins; and
- d. Issues connected with the role of refineries.

These will be reported on at the next workshop.

7

Conclusions and Recommendations

7.1 The workshop addressed six interrelated topics to do with the downstream petroleum distribution and marketing sector—an area of critical importance that dominates the balance of payments of most of the Sub-Saharan countries, particularly the poorer economies in the region. The general question-and-answer sessions following each presentation, and subsequent sub-group discussions, resulted in the following conclusions and recommendations on each topic.

Petroleum Procurement

7.2 The participants in general recognized the substantial savings that could be derived from competitive bidding using the Standard Bidding Document (SBD) prepared by the World Bank. The high cost of previous public sector involvement suggests that the role of governments and government agencies in procurement should be kept to an absolute minimum and should not foster a large bureaucracy, cost center, or equity holder in the product being purchased. The government's role should mainly be that of a facilitating agency, so that several small marketers can pool their resources to conduct joint procurement in a transparent manner and achieve economies of scale. There was the general consensus that the SBD, in conjunction with many governments of the region and industry members, was working reasonably well. The SBD is expected to be more widely used for transactions even where Bank finance is not involved. The participants recommended increased efforts in training and capacity building in petroleum procurement, using the SBD.

Petroleum Product Specifications and Harmonization

7.3 On product specifications, there was consensus among participants that current specifications for gasoline and diesel require changes to reduce the harmful effects on the health of population and on the environment caused by emissions from combustion of these fuels. In particular, the consensus was (a) to eliminate the addition of lead in gasoline over a period of three years, with an immediate shift to a lower lead content of 0.15 grams per liter (as against the present concentration 0.5 to 0.8 grams per liter); and (b) to reduce sulfur content in diesel to 0.5 percent immediately and to 0.2 percent within three years. Sulfur content in residual fuel oil

should be reduced wherever possible, but the workshop recommended that it would be more practical to do so on a case-by-case basis. There was unanimous appreciation of the potential benefits of harmonization of product specifications, but the participants recommended that it be implemented on a sub-regional basis, recognizing differences between regions such as altitude (an important factor in selecting gasoline octane ratings) and the availability of low-sulfur crude oil. Harmonization of specifications has already occurred in the case of jet fuel. The participants suggested that LPG should be included in the list for product harmonization. Regarding the future role of refineries in this respect, the point was made that the government or country concerned should not be held hostage with respect to product choice/source by the existence of a domestic refinery; however, many government representatives recommended more detailed discussions to evaluate the implications for closure of refineries and arranging alternate source of products.

Hazards of Petroleum Road Transportation

7.4 The participants appreciated the concern for safety and need for better regulation as presented in this paper. All felt that no compromise should be made on safety in petroleum road transport. It was also recognized that there is need for a great deal of work to be done to achieve the safety objectives and industry and that governments would have to work together to raise public consciousness. The need for establishing safety standards and clear liability among the parties involved to help ensure those standards, and the country governments' role in establishing those standards, were two important points that came up during the discussions. It was felt that a good part of the safety program could be self-enforced by the industry, as long as suitable incentives were provided through proper legislation and clearly defined liability. In addition, all agreed on the government's responsibility for proper maintenance of roads, and the role of a road user's tax in financing the maintenance. The participants felt that the need for road safety regulations is more important when the petroleum sector is liberalized. The main recommendations included publishing safety requirements, establishing safety regulations and rules for awarding permits to vehicle operators, training vehicle drivers, defining liability and responsibility, and exchanging information on safety aspects and best practices among the countries in SSA.

Petroleum Product Transport Options

7.5 Participants generally recognized that the cost of bulk transport of petroleum products in countries in SSA would be high due to poor infrastructure and low volume of consumption in most of the countries. The problem is further complicated for those countries that are landlocked and/or depend on transshipment of products using facilities existing in the other countries. However, there was appreciation of the ideas presented in this paper for reducing transport costs through rationalization of transport systems on a regional basis. An increasing amount of private sector involvement would be necessary for investing in and managing the bulk transportation facilities to improve their performance and reduce cost through a suitable regulated tariff structure. The advantages of separating roles were recognized, including limiting the government's role to policymaking and establishing a regulatory framework that will ensure a fairly structured tariff that allows reasonable cost recovery and provides a level playing field to all operators and among all different transport options. The need for regional harmonization of

these policies, due to substantial inter-regional dependency, was also agreed on. Part of the paper and subsequent discussions focused on petroleum transportation by pipelines in those areas where the requirements of a few countries could be pooled together to create the minimum required transport volume. The participants, appreciating the concept, recommended a case-by-case review by the parties involved.

Regional LPG Trade in Sub-Saharan Africa

7.6 Participants were of the view that promoting LPG trade in the region is very important in the future because almost 97 percent of households in SSA still rely on biomass for their domestic fuel, resulting in deforestation at an alarming rate and localized air quality problems. The paper presented a persuasive case for LPG as an alternative to traditional fuels, especially in West Africa, where a large increase in production from offshore associated gas has already taken place. However, in order to achieve this objective, a number of problems must be resolved related to excessive government control, the lack of a regulatory framework, pricing of LPG in the retail market, inadequate cost recovery on infrastructure investments, and the need for improvement of facilities for import, storage, distribution, filling and marketing, with the ultimate aim of improving the efficiency of the entire supply system and reducing the delivered cost of LPG to the end users. There was a general consensus that there should not be a special subsidy for LPG and all fuels should compete for market share. Preferential lower taxes on alternative fuels, if any, should apply equally to make for a level competitive playing field. Participants agreed that a knowledge barrier existed with regard to the use of LPG. It was recommended that it should be overcome jointly by the industry and governments in the region. Another recommendation was that the high initial cost of cylinders, stoves, and related items involved in introducing LPG supply should be reduced by offering smaller cylinders; simple, low-cost stoves; and innovative financing schemes to reduce the burden for most households.

Petroleum Product Regulation and Pricing

7.7 The cost to SSA of its poor petroleum practices matches and often exceeds the amount given in annual multilateral aid, which is about US\$1.2 billion. None of the regulatory systems in the sector is independent of political influence. Typically, the retail prices do not fully cover import costs; there are subsidies and cross-subsidies. Against this background, it is essential to implement sector reform through liberalization of the market and prices to make the petroleum supply reliable, efficient, transparent, and cost-effective. In order to achieve genuine liberalization, each country should have an effective regulatory framework and monitoring mechanism. The regulatory body and its monitoring cell should be as independent of government as possible. The regulatory body's expenses should be met through a special levy in the pricing mechanism. The paper summarized best practice based on a sample of countries that have made progress in reforming their petroleum sectors. The next step is to research carefully the successes and failures, to clarify the benefits and costs, and to identify what seems to work and what does not.

Workshop Evaluation and Additional Recommendations

7.8 Table 3 shows how participants rated the workshop, as determined by their answers to a questionnaire.

Table 3. Downstream Petroleum Workshop: Analysis of Questionnaires

	<i>Excellent</i>	<i>Good</i>	<i>Fair</i>	<i>Poor</i>	<i>No Opinion</i>
Relevance	17	11	-	-	1
Timelines	7	17	1	-	4
The Presentations	8	20	1	-	-
Knowledge of Speakers	9	18	2	-	-
Printed material	9	17	3	-	-
Format	13	12	3	-	1
Developing contacts	13	10	5	-	1
Location	13	14	1	-	1
Management & Admin.	17	11	1	-	-
Translation of Presentations	5	13	3	2	6
Accommodation	11	12	3	-	3
Food	10	15	3	1	-
Facilities	10	15	3	-	1
Overall	9	19	-	-	1

7.8 The strongest comments were on translation, especially concerning questions raised by delegates.

7.9 The principal additional recommendation focused on the desirability of follow-on workshops, the first one giving particular emphasis to refinery and pricing issues.

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LIST OF REPORTS ON COMPLETED ACTIVITIES

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
SUB-SAHARAN AFRICA (AFR)			
Africa Regional	Anglophone Africa Household Energy Workshop (English)	07/88	085/88
	Regional Power Seminar on Reducing Electric Power System Losses in Africa (English)	08/88	087/88
	Institutional Evaluation of EGL (English)	02/89	098/89
	Biomass Mapping Regional Workshops (English)	05/89	--
	Francophone Household Energy Workshop (French)	08/89	--
	Interafrican Electrical Engineering College: Proposals for Short- and Long-Term Development (English)	03/90	112/90
	Biomass Assessment and Mapping (English)	03/90	--
	Symposium on Power Sector Reform and Efficiency Improvement in Sub-Saharan Africa (English)	06/96	182/96
	Commercialization of Marginal Gas Fields (English)	12/97	201/97
	Commercializing Natural Gas: Lessons from the Seminar in Nairobi for Sub-Saharan Africa and Beyond	01/00	225/00
	Africa Gas Initiative – Main Report: Volume I	02/01	240/01
	First World Bank Workshop on the Petroleum Products Sector in Sub-Saharan Africa	09/01	245/01
Angola	Energy Assessment (English and Portuguese)	05/89	4708-ANG
	Power Rehabilitation and Technical Assistance (English)	10/91	142/91
	Africa Gas Initiative – Angola: Volume II	02/01	240/01
Benin	Energy Assessment (English and French)	06/85	5222-BEN
Botswana	Energy Assessment (English)	09/84	4998-BT
	Pump Electrification Prefeasibility Study (English)	01/86	047/86
	Review of Electricity Service Connection Policy (English)	07/87	071/87
	Tuli Block Farms Electrification Study (English)	07/87	072/87
	Household Energy Issues Study (English)	02/88	--
	Urban Household Energy Strategy Study (English)	05/91	132/91
Burkina Faso	Energy Assessment (English and French)	01/86	5730-BUR
	Technical Assistance Program (English)	03/86	052/86
	Urban Household Energy Strategy Study (English and French)	06/91	134/91
Burundi	Energy Assessment (English)	06/82	3778-BU
	Petroleum Supply Management (English)	01/84	012/84
	Status Report (English and French)	02/84	011/84
	Presentation of Energy Projects for the Fourth Five-Year Plan (1983-1987) (English and French)	05/85	036/85
	Improved Charcoal Cookstove Strategy (English and French)	09/85	042/85
	Peat Utilization Project (English)	11/85	046/85
	Energy Assessment (English and French)	01/92	9215-BU
Cameroon	Africa Gas Initiative – Cameroon: Volume III	02/01	240/01
Cape Verde	Energy Assessment (English and Portuguese)	08/84	5073-CV
	Household Energy Strategy Study (English)	02/90	110/90
Central African Republic	Energy Assessment (French)	08/92	9898-CAR
Chad	Elements of Strategy for Urban Household Energy The Case of N'djamena (French)	12/93	160/94

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
Comoros	Energy Assessment (English and French)	01/88	7104-COM
	In Search of Better Ways to Develop Solar Markets: The Case of Comoros	05/00	230/00
Congo	Energy Assessment (English)	01/88	6420-COB
	Power Development Plan (English and French)	03/90	106/90
	Africa Gas Initiative – Congo: Volume IV	02/01	240/01
Côte d'Ivoire	Energy Assessment (English and French)	04/85	5250-IVC
	Improved Biomass Utilization (English and French)	04/87	069/87
	Power System Efficiency Study (English)	12/87	--
	Power Sector Efficiency Study (French)	02/92	140/91
	Project of Energy Efficiency in Buildings (English)	09/95	175/95
	Africa Gas Initiative – Côte d'Ivoire: Volume V	02/01	240/01
Ethiopia	Energy Assessment (English)	07/84	4741-ET
	Power System Efficiency Study (English)	10/85	045/85
	Agricultural Residue Briquetting Pilot Project (English)	12/86	062/86
	Bagasse Study (English)	12/86	063/86
	Cooking Efficiency Project (English)	12/87	--
	Energy Assessment (English)	02/96	179/96
Gabon	Energy Assessment (English)	07/88	6915-GA
	Africa Gas Initiative – Gabon: Volume VI	02/01	240/01
The Gambia	Energy Assessment (English)	11/83	4743-GM
	Solar Water Heating Retrofit Project (English)	02/85	030/85
	Solar Photovoltaic Applications (English)	03/85	032/85
	Petroleum Supply Management Assistance (English)	04/85	035/85
Ghana	Energy Assessment (English)	11/86	6234-GH
	Energy Rationalization in the Industrial Sector (English)	06/88	084/88
	Sawmill Residues Utilization Study (English)	11/88	074/87
	Industrial Energy Efficiency (English)	11/92	148/92
Guinea	Energy Assessment (English)	11/86	6137-GUI
	Household Energy Strategy (English and French)	01/94	163/94
Guinea-Bissau	Energy Assessment (English and Portuguese)	08/84	5083-GUB
	Recommended Technical Assistance Projects (English & Portuguese)	04/85	033/85
	Management Options for the Electric Power and Water Supply Subsectors (English)	02/90	100/90
	Power and Water Institutional Restructuring (French)	04/91	118/91
Kenya	Energy Assessment (English)	05/82	3800-KE
	Power System Efficiency Study (English)	03/84	014/84
	Status Report (English)	05/84	016/84
	Coal Conversion Action Plan (English)	02/87	--
	Solar Water Heating Study (English)	02/87	066/87
	Peri-Urban Woodfuel Development (English)	10/87	076/87
	Power Master Plan (English)	11/87	--
	Power Loss Reduction Study (English)	09/96	186/96
	Implementation Manual: Financing Mechanisms for Solar Electric Equipment	07/00	231/00
Lesotho	Energy Assessment (English)	01/84	4676-LSO
Liberia	Energy Assessment (English)	12/84	5279-LBR
	Recommended Technical Assistance Projects (English)	06/85	038/85
	Power System Efficiency Study (English)	12/87	081/87
Madagascar	Energy Assessment (English)	01/87	5700-MAG
	Power System Efficiency Study (English and French)	12/87	075/87

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Madagascar	Environmental Impact of Woodfuels (French)	10/95	176/95
Malawi	Energy Assessment (English)	08/82	3903-MAL
	Technical Assistance to Improve the Efficiency of Fuelwood Use in the Tobacco Industry (English)	11/83	009/83
	Status Report (English)	01/84	013/84
Mali	Energy Assessment (English and French)	11/91	8423-MLI
	Household Energy Strategy (English and French)	03/92	147/92
Islamic Republic of Mauritania	Energy Assessment (English and French)	04/85	5224-MAU
	Household Energy Strategy Study (English and French)	07/90	123/90
Mauritius	Energy Assessment (English)	12/81	3510-MAS
	Status Report (English)	10/83	008/83
	Power System Efficiency Audit (English)	05/87	070/87
	Bagasse Power Potential (English)	10/87	077/87
	Energy Sector Review (English)	12/94	3643-MAS
Mozambique	Energy Assessment (English)	01/87	6128-MOZ
	Household Electricity Utilization Study (English)	03/90	113/90
	Electricity Tariffs Study (English)	06/96	181/96
	Sample Survey of Low Voltage Electricity Customers	06/97	195/97
Namibia	Energy Assessment (English)	03/93	11320-NAM
Niger	Energy Assessment (French)	05/84	4642-NIR
	Status Report (English and French)	02/86	051/86
	Improved Stoves Project (English and French)	12/87	080/87
	Household Energy Conservation and Substitution (English and French)	01/88	082/88
Nigeria	Energy Assessment (English)	08/83	4440-UNI
	Energy Assessment (English)	07/93	11672-UNI
Rwanda	Energy Assessment (English)	06/82	3779-RW
	Status Report (English and French)	05/84	017/84
	Improved Charcoal Cookstove Strategy (English and French)	08/86	059/86
	Improved Charcoal Production Techniques (English and French)	02/87	065/87
	Energy Assessment (English and French)	07/91	8017-RW
	Commercialization of Improved Charcoal Stoves and Carbonization Techniques Mid-Term Progress Report (English and French)	12/91	141/91
SADC	SADC Regional Power Interconnection Study, Vols. I-IV (English)	12/93	--
SADCC	SADCC Regional Sector: Regional Capacity-Building Program for Energy Surveys and Policy Analysis (English)	11/91	--
Sao Tome and Principe	Energy Assessment (English)	10/85	5803-STP
Senegal	Energy Assessment (English)	07/83	4182-SE
	Status Report (English and French)	10/84	025/84
	Industrial Energy Conservation Study (English)	05/85	037/85
	Preparatory Assistance for Donor Meeting (English and French)	04/86	056/86
	Urban Household Energy Strategy (English)	02/89	096/89
	Industrial Energy Conservation Program (English)	05/94	165/94
Seychelles	Energy Assessment (English)	01/84	4693-SEY
	Electric Power System Efficiency Study (English)	08/84	021/84
Sierra Leone	Energy Assessment (English)	10/87	6597-SL
Somalia	Energy Assessment (English)	12/85	5796-SO
Republic of South Africa	Options for the Structure and Regulation of Natural Gas Industry (English)	05/95	172/95

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Sudan	Management Assistance to the Ministry of Energy and Mining	05/83	003/83
	Energy Assessment (English)	07/83	4511-SU
	Power System Efficiency Study (English)	06/84	018/84
	Status Report (English)	11/84	026/84
	Wood Energy/Forestry Feasibility (English)	07/87	073/87
Swaziland	Energy Assessment (English)	02/87	6262-SW
	Household Energy Strategy Study	10/97	198/97
Tanzania	Energy Assessment (English)	11/84	4969-TA
	Peri-Urban Woodfuels Feasibility Study (English)	08/88	086/88
	Tobacco Curing Efficiency Study (English)	05/89	102/89
	Remote Sensing and Mapping of Woodlands (English)	06/90	--
	Industrial Energy Efficiency Technical Assistance (English)	08/90	122/90
	Power Loss Reduction Volume 1: Transmission and Distribution System Technical Loss Reduction and Network Development (English)	06/98	204A/98
	Power Loss Reduction Volume 2: Reduction of Non-Technical Losses (English)	06/98	204B/98
Togo	Energy Assessment (English)	06/85	5221-TO
	Wood Recovery in the Nangbeto Lake (English and French)	04/86	055/86
	Power Efficiency Improvement (English and French)	12/87	078/87
Uganda	Energy Assessment (English)	07/83	4453-UG
	Status Report (English)	08/84	020/84
	Institutional Review of the Energy Sector (English)	01/85	029/85
	Energy Efficiency in Tobacco Curing Industry (English)	02/86	049/86
	Fuelwood/Forestry Feasibility Study (English)	03/86	053/86
	Power System Efficiency Study (English)	12/88	092/88
	Energy Efficiency Improvement in the Brick and Tile Industry (English)	02/89	097/89
	Tobacco Curing Pilot Project (English)	03/89	UNDP Terminal Report
	Energy Assessment (English)	12/96	193/96
	Rural Electrification Strategy Study	09/99	221/99
Zaire	Energy Assessment (English)	05/86	5837-ZR
Zambia	Energy Assessment (English)	01/83	4110-ZA
	Status Report (English)	08/85	039/85
	Energy Sector Institutional Review (English)	11/86	060/86
	Power Subsector Efficiency Study (English)	02/89	093/88
	Energy Strategy Study (English)	02/89	094/88
	Urban Household Energy Strategy Study (English)	08/90	121/90
	Energy Assessment (English)	06/82	3765-ZIM
Zimbabwe	Power System Efficiency Study (English)	06/83	005/83
	Status Report (English)	08/84	019/84
	Power Sector Management Assistance Project (English)	04/85	034/85
	Power Sector Management Institution Building (English)	09/89	--
	Petroleum Management Assistance (English)	12/89	109/89
	Charcoal Utilization Prefeasibility Study (English)	06/90	119/90
	Integrated Energy Strategy Evaluation (English)	01/92	8768-ZIM
	Energy Efficiency Technical Assistance Project: Strategic Framework for a National Energy Efficiency Improvement Program (English)	04/94	--
	Capacity Building for the National Energy Efficiency Improvement Programme (NEEIP) (English)	12/94	--

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Zimbabwe	Rural Electrification Study	03/00	228/00
EAST ASIA AND PACIFIC (EAP)			
Asia Regional	Pacific Household and Rural Energy Seminar (English)	11/90	--
China	County-Level Rural Energy Assessments (English)	05/89	101/89
	Fuelwood Forestry Preinvestment Study (English)	12/89	105/89
	Strategic Options for Power Sector Reform in China (English)	07/93	156/93
	Energy Efficiency and Pollution Control in Township and Village Enterprises (TVE) Industry (English)	11/94	168/94
	Energy for Rural Development in China: An Assessment Based on a Joint Chinese/ESMAP Study in Six Counties (English)	06/96	183/96
	Improving the Technical Efficiency of Decentralized Power Companies	09/99	222/999
Fiji	Energy Assessment (English)	06/83	4462-FIJ
Indonesia	Energy Assessment (English)	11/81	3543-IND
	Status Report (English)	09/84	022/84
	Power Generation Efficiency Study (English)	02/86	050/86
	Energy Efficiency in the Brick, Tile and Lime Industries (English)	04/87	067/87
	Diesel Generating Plant Efficiency Study (English)	12/88	095/88
	Urban Household Energy Strategy Study (English)	02/90	107/90
	Biomass Gasifier Preinvestment Study Vols. I & II (English)	12/90	124/90
	Prospects for Biomass Power Generation with Emphasis on Palm Oil, Sugar, Rubberwood and Plywood Residues (English)	11/94	167/94
Lao PDR	Urban Electricity Demand Assessment Study (English)	03/93	154/93
	Institutional Development for Off-Grid Electrification	06/99	215/99
Malaysia	Sabah Power System Efficiency Study (English)	03/87	068/87
	Gas Utilization Study (English)	09/91	9645-MA
Myanmar	Energy Assessment (English)	06/85	5416-BA
Papua New Guinea	Energy Assessment (English)	06/82	3882-PNG
	Status Report (English)	07/83	006/83
	Energy Strategy Paper (English)	--	--
	Institutional Review in the Energy Sector (English)	10/84	023/84
	Power Tariff Study (English)	10/84	024/84
Philippines	Commercial Potential for Power Production from Agricultural Residues (English)	12/93	157/93
	Energy Conservation Study (English)	08/94	--
	Strengthening the Non-Conventional and Rural Energy Development Program in the Philippines: A Policy Framework and Action Plan	08/01	243/01
Solomon Islands	Energy Assessment (English)	06/83	4404-SOL
	Energy Assessment (English)	01/92	979-SOL
South Pacific	Petroleum Transport in the South Pacific (English)	05/86	--
Thailand	Energy Assessment (English)	09/85	5793-TH
	Rural Energy Issues and Options (English)	09/85	044/85
	Accelerated Dissemination of Improved Stoves and Charcoal Kilns (English)	09/87	079/87
	Northeast Region Village Forestry and Woodfuels Preinvestment Study (English)	02/88	083/88

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Thailand	Impact of Lower Oil Prices (English)	08/88	--
	Coal Development and Utilization Study (English)	10/89	--
Tonga	Energy Assessment (English)	06/85	5498-TON
Vanuatu	Energy Assessment (English)	06/85	5577-VA
Vietnam	Rural and Household Energy-Issues and Options (English)	01/94	161/94
	Power Sector Reform and Restructuring in Vietnam: Final Report to the Steering Committee (English and Vietnamese)	09/95	174/95
	Household Energy Technical Assistance: Improved Coal Briquetting and Commercialized Dissemination of Higher Efficiency Biomass and Coal Stoves (English)	01/96	178/96
	Petroleum Fiscal Issues and Policies for Fluctuating Oil Prices In Vietnam	02/01	236/01
Western Samoa	Energy Assessment (English)	06/85	5497-WSO
SOUTH ASIA (SAS)			
Bangladesh	Energy Assessment (English)	10/82	3873-BD
	Priority Investment Program (English)	05/83	002/83
	Status Report (English)	04/84	015/84
	Power System Efficiency Study (English)	02/85	031/85
	Small Scale Uses of Gas Prefeasibility Study (English)	12/88	--
India	Opportunities for Commercialization of Nonconventional Energy Systems (English)	11/88	091/88
	Maharashtra Bagasse Energy Efficiency Project (English)	07/90	120/90
	Mini-Hydro Development on Irrigation Dams and Canal Drops Vols. I, II and III (English)	07/91	139/91
	WindFarm Pre-Investment Study (English)	12/92	150/92
	Power Sector Reform Seminar (English)	04/94	166/94
	Environmental Issues in the Power Sector (English)	06/98	205/98
	Environmental Issues in the Power Sector: Manual for Environmental Decision Making (English)	06/99	213/99
	Household Energy Strategies for Urban India: The Case of Hyderabad	06/99	214/99
	Greenhouse Gas Mitigation In the Power Sector: Case Studies From India	02/01	237/01
Nepal	Energy Assessment (English)	08/83	4474-NEP
	Status Report (English)	01/85	028/84
	Energy Efficiency & Fuel Substitution in Industries (English)	06/93	158/93
Pakistan	Household Energy Assessment (English)	05/88	--
	Assessment of Photovoltaic Programs, Applications, and Markets (English)	10/89	103/89
	National Household Energy Survey and Strategy Formulation Study: Project Terminal Report (English)	03/94	--
	Managing the Energy Transition (English)	10/94	--
	Lighting Efficiency Improvement Program Phase 1: Commercial Buildings Five Year Plan (English)	10/94	--
Sri Lanka	Energy Assessment (English)	05/82	3792-CE
	Power System Loss Reduction Study (English)	07/83	007/83
	Status Report (English)	01/84	010/84
	Industrial Energy Conservation Study (English)	03/86	054/86

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EUROPE AND CENTRAL ASIA (ECA)			
Bulgaria	Natural Gas Policies and Issues (English)	10/96	188/96
Central Asia and The Caucasus	Cleaner Transport Fuels in Central Asia and the Caucasus	08/01	242/01
Central and Eastern Europe	Power Sector Reform in Selected Countries	07/97	196/97
	Increasing the Efficiency of Heating Systems in Central and Eastern Europe and the Former Soviet Union	08/00	234/00
	The Future of Natural Gas in Eastern Europe (English)	08/92	149/92
Kazakhstan	Natural Gas Investment Study, Volumes 1, 2 & 3	12/97	199/97
Kazakhstan & Kyrgyzstan	Opportunities for Renewable Energy Development	11/97	16855-KAZ
Poland	Energy Sector Restructuring Program Vols. I-V (English)	01/93	153/93
	Natural Gas Upstream Policy (English and Polish)	08/98	206/98
	Energy Sector Restructuring Program: Establishing the Energy Regulation Authority	10/98	208/98
Portugal	Energy Assessment (English)	04/84	4824-PO
Romania	Natural Gas Development Strategy (English)	12/96	192/96
Slovenia	Workshop on Private Participation in the Power Sector (English)	02/99	211/99
Turkey	Energy Assessment (English)	03/83	3877-TU
	Energy and the Environment: Issues and Options Paper	04/00	229/00
MIDDLE EAST AND NORTH AFRICA (MNA)			
Arab Republic of Egypt	Energy Assessment (English)	10/96	189/96
	Energy Assessment (English and French)	03/84	4157-MOR
	Status Report (English and French)	01/86	048/86
Morocco	Energy Sector Institutional Development Study (English and French)	07/95	173/95
	Natural Gas Pricing Study (French)	10/98	209/98
	Gas Development Plan Phase II (French)	02/99	210/99
Syria	Energy Assessment (English)	05/86	5822-SYR
	Electric Power Efficiency Study (English)	09/88	089/88
	Energy Efficiency Improvement in the Cement Sector (English)	04/89	099/89
	Energy Efficiency Improvement in the Fertilizer Sector (English)	06/90	115/90
Tunisia	Fuel Substitution (English and French)	03/90	--
	Power Efficiency Study (English and French)	02/92	136/91
	Energy Management Strategy in the Residential and Tertiary Sectors (English)	04/92	146/92
	Renewable Energy Strategy Study, Volume I (French)	11/96	190A/96
	Renewable Energy Strategy Study, Volume II (French)	11/96	190B/96
Yemen	Energy Assessment (English)	12/84	4892-YAR
	Energy Investment Priorities (English)	02/87	6376-YAR
	Household Energy Strategy Study Phase I (English)	03/91	126/91
LATIN AMERICA AND THE CARIBBEAN (LAC)			
LAC Regional	Regional Seminar on Electric Power System Loss Reduction in the Caribbean (English)	07/89	--

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LAC Regional	Elimination of Lead in Gasoline in Latin America and the Caribbean (English and Spanish)	04/97	194/97
	Elimination of Lead in Gasoline in Latin America and the Caribbean - Status Report (English and Spanish)	12/97	200/97
	Harmonization of Fuels Specifications in Latin America and the Caribbean (English and Spanish)	06/98	203/98
Bolivia	Energy Assessment (English)	04/83	4213-BO
	National Energy Plan (English)	12/87	--
	La Paz Private Power Technical Assistance (English)	11/90	111/90
	Prefeasibility Evaluation Rural Electrification and Demand Assessment (English and Spanish)	04/91	129/91
	National Energy Plan (Spanish)	08/91	131/91
	Private Power Generation and Transmission (English)	01/92	137/91
	Natural Gas Distribution: Economics and Regulation (English)	03/92	125/92
	Natural Gas Sector Policies and Issues (English and Spanish)	12/93	164/93
	Household Rural Energy Strategy (English and Spanish)	01/94	162/94
	Preparation of Capitalization of the Hydrocarbon Sector	12/96	191/96
	Introducing Competition into the Electricity Supply Industry in Developing Countries: Lessons from Bolivia	08/00	233/00
	Final Report on Operational Activities Rural Energy and Energy Efficiency	08/00	235/00
	Oil Industry Training for Indigenous People: The Bolivian Experience (English and Spanish)	09/01	244/01
Brazil	Energy Efficiency & Conservation: Strategic Partnership for Energy Efficiency in Brazil (English)	01/95	170/95
	Hydro and Thermal Power Sector Study	09/97	197/97
	Rural Electrification with Renewable Energy Systems in the Northeast: A Preinvestment Study	07/00	232/00
Chile	Energy Sector Review (English)	08/88	7129-CH
Colombia	Energy Strategy Paper (English)	12/86	--
	Power Sector Restructuring (English)	11/94	169/94
	Energy Efficiency Report for the Commercial and Public Sector (English)	06/96	184/96
Costa Rica	Energy Assessment (English and Spanish)	01/84	4655-CR
	Recommended Technical Assistance Projects (English)	11/84	027/84
	Forest Residues Utilization Study (English and Spanish)	02/90	108/90
Dominican Republic	Energy Assessment (English)	05/91	8234-DO
Ecuador	Energy Assessment (Spanish)	12/85	5865-EC
	Energy Strategy Phase I (Spanish)	07/88	--
	Energy Strategy (English)	04/91	--
	Private Minihydropower Development Study (English)	11/92	--
	Energy Pricing Subsidies and Interfuel Substitution (English)	08/94	11798-EC
	Energy Pricing, Poverty and Social Mitigation (English)	08/94	12831-EC
Guatemala	Issues and Options in the Energy Sector (English)	09/93	12160-GU
Haiti	Energy Assessment (English and French)	06/82	3672-HA
	Status Report (English and French)	08/85	041/85
	Household Energy Strategy (English and French)	12/91	143/91
Honduras	Energy Assessment (English)	08/87	6476-HO
	Petroleum Supply Management (English)	03/91	128/91
Jamaica	Energy Assessment (English)	04/85	5466-JM

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Jamaica	Petroleum Procurement, Refining, and Distribution Study (English)	11/86	061/86
	Energy Efficiency Building Code Phase I (English)	03/88	--
	Energy Efficiency Standards and Labels Phase I (English)	03/88	--
	Management Information System Phase I (English)	03/88	--
	Charcoal Production Project (English)	09/88	090/88
	FIDCO Sawmill Residues Utilization Study (English)	09/88	088/88
	Energy Sector Strategy and Investment Planning Study (English)	07/92	135/92
Mexico	Improved Charcoal Production Within Forest Management for the State of Veracruz (English and Spanish)	08/91	138/91
	Energy Efficiency Management Technical Assistance to the Comision Nacional para el Ahorro de Energia (CONAE) (English)	04/96	180/96
	Energy Environment Review	05/01	241/01
Panama	Power System Efficiency Study (English)	06/83	004/83
Paraguay	Energy Assessment (English)	10/84	5145-PA
	Recommended Technical Assistance Projects (English)	09/85	--
	Status Report (English and Spanish)	09/85	043/85
Peru	Energy Assessment (English)	01/84	4677-PE
	Status Report (English)	08/85	040/85
	Proposal for a Stove Dissemination Program in the Sierra (English and Spanish)	02/87	064/87
	Energy Strategy (English and Spanish)	12/90	--
	Study of Energy Taxation and Liberalization of the Hydrocarbons Sector (English and Spanish)	120/93	159/93
	Reform and Privatization in the Hydrocarbon Sector (English and Spanish)	07/99	216/99
	Rural Electrification	02/01	238/01
Saint Lucia	Energy Assessment (English)	09/84	5111-SLU
St. Vincent and the Grenadines	Energy Assessment (English)	09/84	5103-STV
Sub Andean	Environmental and Social Regulation of Oil and Gas Operations in Sensitive Areas of the Sub-Andean Basin (English and Spanish)	07/99	217/99
	Energy Assessment (English)	12/85	5930-TR
Trinidad and Tobago	Energy Assessment (English)	12/85	5930-TR
GLOBAL			
	Energy End Use Efficiency: Research and Strategy (English)	11/89	--
	Women and Energy--A Resource Guide		
	The International Network: Policies and Experience (English)	04/90	--
	Guidelines for Utility Customer Management and Metering (English and Spanish)	07/91	--
	Assessment of Personal Computer Models for Energy Planning in Developing Countries (English)	10/91	--
	Long-Term Gas Contracts Principles and Applications (English)	02/93	152/93
	Comparative Behavior of Firms Under Public and Private Ownership (English)	05/93	155/93
	Development of Regional Electric Power Networks (English)	10/94	--
	Roundtable on Energy Efficiency (English)	02/95	171/95

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Global	Assessing Pollution Abatement Policies with a Case Study of Ankara (English)	11/95	177/95
	A Synopsis of the Third Annual Roundtable on Independent Power Projects: Rhetoric and Reality (English)	08/96	187/96
	Rural Energy and Development Roundtable (English)	05/98	202/98
	A Synopsis of the Second Roundtable on Energy Efficiency: Institutional and Financial Delivery Mechanisms (English)	09/98	207/98
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	Global Energy Sector Reform in Developing Countries: A Scorecard	07/99	219/99
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	Undeveloped Oil and Gas Fields in the Industrializing World	02/01	239/01

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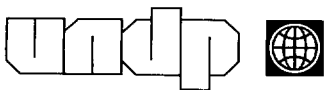
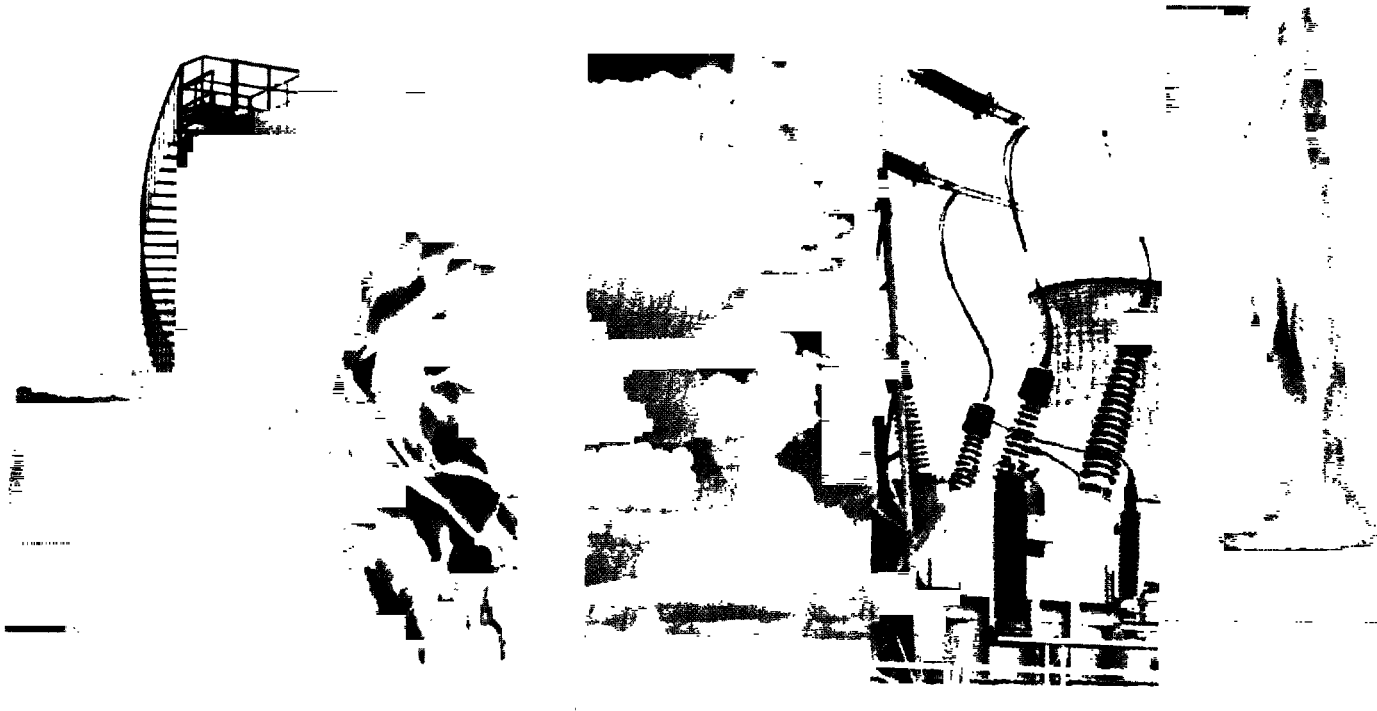
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