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### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bpd</td>
<td>Barrels per day</td>
</tr>
<tr>
<td>EAC</td>
<td>East African Community</td>
</tr>
<tr>
<td>EWURA</td>
<td>Energy and Water Utilities Regulatory Authority, Tanzania</td>
</tr>
<tr>
<td>KOJ</td>
<td>Kurasini Oil Jetty</td>
</tr>
<tr>
<td>KOSF</td>
<td>Kipevu Oil Storage Facility</td>
</tr>
<tr>
<td>KPC</td>
<td>Kenya Pipeline Company</td>
</tr>
<tr>
<td>KPRL</td>
<td>Kenya Petroleum Refineries Limited</td>
</tr>
<tr>
<td>LPG</td>
<td>Liquefied Petroleum Gas</td>
</tr>
<tr>
<td>MIDOR</td>
<td>Middle East Oil Refinery</td>
</tr>
<tr>
<td>mmscfd</td>
<td>Million standard cubic feet per day</td>
</tr>
<tr>
<td>MW</td>
<td>Mega watt</td>
</tr>
<tr>
<td>NOCK</td>
<td>National Oil Corporation of Kenya</td>
</tr>
<tr>
<td>SBM</td>
<td>Single Buoy Mooring</td>
</tr>
<tr>
<td>SWOT</td>
<td>Strength, Weaknesses, Opportunities and Threats</td>
</tr>
<tr>
<td>TAZAMA</td>
<td>Tanzania Zambia pipelines</td>
</tr>
<tr>
<td>TAZARA</td>
<td>Tanzania Zambia Railway Authority</td>
</tr>
<tr>
<td>tcf</td>
<td>Trillion cubic feet</td>
</tr>
<tr>
<td>TIPER</td>
<td>Tanganyika Italy Petroleum Refinery</td>
</tr>
<tr>
<td>TPDC</td>
<td>Tanzania Petroleum Development Corporation</td>
</tr>
<tr>
<td>TRL</td>
<td>Tanzania Railways Limited</td>
</tr>
</tbody>
</table>
EXECUTIVE SUMMARY

At its Extra-Ordinary Meeting in Kampala on 18th June 2007, the East African Community Summit of the Heads of State, in recognition of the importance of boosting the capacity of refinery services in the region and in view of recent discoveries of oil in Uganda and gas in Tanzania directed the East African Community (EAC) Secretariat to develop a strategy for the development of refineries in the region.

There have been accelerated and significant activities in the petroleum upstream sector in the East African region. Partner States are undertaking numerous exploration activities in the various regions and significant discoveries have been realized. Tanzania has discovered gas in the Songo Songo basin, Mnazi Bay and Mkuranga production of which started in 2004. Further exploration activities are in progress in the coastal and offshore areas in the Indian Ocean.

Uganda has made oil discoveries in some of the exploration areas in the Albert Graben. More exploration work is still being undertaken. There are also exploration activities in the Northern and Lamu regions of Kenya and Lake Kivu in Rwanda. All these present a great potential of a strong oil and gas industry in the region.

The Strategy for Development of Regional Refineries seeks a harmonised development of refineries and associated supporting infrastructure. It addresses issues pertaining to establishment, location, ownership structure, operational logistics and capacity.

In developing the Strategy the existing policy, legal regulatory and institutional framework to support development of refineries was examined as well as the contractual and operational status of the existing refinery. Issues that need to be addressed at national and regional levels for the purpose of promoting optimal development of refineries were also considered. An analysis of the strengths, constraints, weaknesses and threats of the current systems was undertaken with regard to the region’s current and projected needs. The analysis addressed crude oil supply, refinery capacities, storage and transportation infrastructure. Due consideration was given to the implication of the recent crude oil discoveries in Uganda and ongoing exploration activities in the other Partner States.

The policies, legal, regulatory and institutional frameworks of Partner States indicate efforts and commitment to develop energy needs for the respective States. However, importance of regional cooperation on infrastructure development needs to be emphasized and incorporated in the national policies in order to promote cross border investment for energy projects within the region.

Traditionally global refineries have been large and fewer, most of these set up more than 30 years ago. The industrial countries delay from building new refineries suggests that the refining industry will go back to the locations of the crude oil production, in the producing nations, which allows them to play a bigger role in the global market. Africa has 50 refineries out of a global population of 689 refineries. The average processing capacity of refineries in Africa is 70,000 bpd lower than the world average of about 122,500 bpd. East Africa, with only one refinery processing
70,000 bpd, has the lowest distribution of refineries in Africa. All the refineries in Africa are basically of the topping/reforming type, except for the four refineries in South Africa, two in Egypt, three in Nigeria, one in Cote d’Ivoire, and one in Ghana, which are of the cracking type. Refineries of topping/reforming type result in residue yield ranging between 30-70% depending on the crude type. Residue has the least price in the market compared to crude and the other products. Generally, a higher residue yield from a refinery results in reduction in the refinery margin. Consequently, to improve their profitability modern refineries have a process cracks the residue and produces the higher valued products i.e. gas, naptha, kerosene and diesel.

East Africa, with only one refinery, has the lowest distribution of refineries in Africa. The Kenya Petroleum Refineries Limited (KPRL) is the only refinery in East Africa. It has an installed capacity of 3.2 million tonnes per year (70,000 bpd) but currently processes 1.6 million tonnes per year against a regional demand of 5.7 million tonnes. It also produces 30,000 tonnes of LPG annually, compared to an estimated regional demand of 62,000 tonnes.

The Strategy has considered the existing distribution system and storage capacities made recommendations for improvement, enhancement and expansion in order facilitate provision of efficient and reliable delivery of oil products throughout the region. There are two main routes for distribution of products in the region: the northern and southern corridors. The northern corridor covers supply of products to Kenya, Uganda, Rwanda, Burundi, Eastern DRC and Southern Sudan through the Mombasa port. The southern corridor covers supply of products to Tanzania, Uganda, Rwanda, Burundi and Eastern DRC through the Dar es Salaam port. Most products to Uganda, Rwanda and Burundi are transported through the northern corridor. They are transported by pipeline between Mombasa and Eldoret and then by road. Burundi also imports a small amount through Zambia via Lake Tanganyika.

In preparing the Strategy, the need to address development issues pertaining to the exploitation of the fossil fuel resources in a way that ensures sustainable social and economic development in the region, is recognized. Therefore, the vision for the Strategy on Development of Regional Refineries is:

To achieve maximum value addition to the regional fossil fuels for improved quality of life for the people of East Africa.

The strategy identifies the key stakeholders as including, the people of East Africa, Investors, Development Partners and neighbouring countries. From this identification, the objectives of this strategy are, to;
- boost the region’s refining capacity;
- contribute to the region’s growing energy needs;
- attain security of supply of fossil fuels in the region;
- achieve least cost supply of products;
- earn revenues to support development in the region including poverty reduction, education, health and other human development;
- create investment opportunities in the region;
- create employment and assist in wealth distribution;
- enable transfer of knowledge and ensure availability of technically qualified human resource in the region; and
- facilitate the region’s industrialisation process.
• contribute to sustainable development of the region;

The following recommendations were drawn:

1. Refineries development
   i) In order for the oil discovered in Uganda to provide optimal benefits to the region, it is recommended that a refinery be developed near the oil fields in Uganda contingent on the relevant studies and assessments including firming up of reserves.
   ii) The planned upgrading of the Mombasa refinery should be accelerated;

2. Storage Facilities
   i) Additional storage facilities should be installed in Uganda to ensure strategic coverage at least 30 days of operation.

3. Pipelines
   i) The Eldoret-Kampala pipeline project should proceed as a priority;
   ii) The planned capacity enhancement of Mombasa-Nairobi pipeline should be fast tracked;
   iii) Implementation of a parallel pipeline from Nairobi to Eldoret should be fast tracked;
   iv) Feasibility study for the Kampala-Kigali-Bujumbura should be expedited;
   v) Development of the proposed Dar es Salaam-Tanga-Mombasa natural gas pipeline should be expedited and;
   vi) The proposed Dar es Salaam-Mwanza oil pipeline should be studied with a view to effecting implementation.

4. Port Facilities
   i) Replacement of SBM at Dar es Salaam port into a multiple product off loading facilities should be undertaken as a priority;
   ii) Development of the proposed second oil jetty in Mombasa should be prioritized to boost the handling capacity at the Mombasa port;
   iii) Refurbishment and improvement of handling and receiving facilities including ferries and barges at the inland ports of Port Bell, Jinja, Mwanza, Kigoma and Bujumbura should be prioritised; and
   iv) Construction and development of a jetty at Kisumu port should be prioritized.

5. Railways
   i) Improvement in efficiency and infrastructure on the southern corridor line between Dar es Salaam and Mwanza and Kigoma; and
   ii) Improvement in efficiency and infrastructure on the northern corridor line between Mombasa and Kasese.

6. Roads
   i) Improvement of bad sections on the southern corridor road system Dar es Salaam-Isaka-Bujumbura/Kigali/Mutukula; and
ii) Improvement of bad sections on the northern corridor line Mombasa – Busia/Malaba-Kampala-Kigali-Bujumbura.

7. Possible Future Projects

i) Southern Sudan pipeline
   With regard to crude from Southern Sudan, there are potential financial, social and environmental benefits for the development of a pipeline from Southern Sudan to the East Coast.

ii) Kampala-Juba Railway Line.
   With peace having returned to Southern Sudan, this region has witnessed tremendous growth in economic activity. Currently, there is significant movement of goods including petroleum products from Uganda into Southern Sudan. A railway line from Kampala would further promote this trade.

This Strategy has been structured for the period 2008-2013. Various options for organizational and ownership structure for future development of refinery(ies) and associated infrastructure, the resources and capacity requirements focusing on the financing options and human resources requirements have been explored. In order for the Strategy to succeed and achieve its objectives, the following will need to be undertaken as a matter of priority:

i) Coordinating Committee
   Following adoption of the Strategy by the Partner States, a Coordinating Committee should be established to spearhead implementation of the Strategy.

ii) Memorandum of Understanding
   Following adoption of the Strategy by the Partner States, an MOU should be signed within 12 months.

iii) Human Resource Development
   The upstream activities in the region are progressing at a steady rate. The refinery developments are already underway. It is therefore important that the training and development of the critical mass to support the refinery development and related infrastructure is accelerated.
1 INTRODUCTION

1.1 Background

At its Extra-Ordinary Meeting in Kampala on 18th June 2007, the East African Community Summit of the Heads of State, in recognition of the importance of boosting the capacity of refinery services in the region and in view of recent discoveries of oil in Uganda and gas in Tanzania directed the East African Community (EAC) Secretariat to develop a strategy for the development of refineries in the region.

Discoveries of hydrocarbon resources in the Albertine Graben in Uganda provide an opportunity for strengthening the region’s fossil fuel supplies. For those resources to provide optimal benefits to the region, their utilisation will have to be considered in the context of the region’s evolving energy needs, other available energy resources, infrastructure requirements, environmental issues and alternative export opportunities especially to countries in the wider region which have significant energy trade links with the EAC.

A Task Force comprising officers from the petroleum sub-sector in the Partner States was formed and mandated to undertake the assignment. The aim of the assignment was to address issues pertaining to establishment, location, ownership structure, operational logistics, capacity of refineries and supporting infrastructure. This is a report of the findings and recommendations of the Task Force as per The Terms of Reference attached in Appendix I.

1.2 Objectives

The overall objective of the assignment was to prepare a strategy for harmonised development of refinery services in the region. Specific objectives include:

i. Examine the existing policy, legal, regulatory and institutional framework on refinery development in the region.

ii. Examine the current contractual and operational status of the existing refinery.

iii. Examine the issues which need to be addressed at national and regional levels for the purpose of promoting optimal refinery development in the region.

1.3 Refinery Outlook

Oil refineries convert crude oil into fuel products, lubricating oils, bitumen and chemical feedstocks. Oil refineries are generally large and complex industrial plants, however simple ones also exist but these produce limited end-user products. The main processes in a refinery are as follows:

i) Distillation
This is a primary process which entails the cleaning up of the crude to remove excessive salts (desalting) followed by heating to 350-370°C to allow the naturally existing streams of gas, naptha, kerosene, gas oil (diesel) and residue to separate out as the mixture is allowed to cool down in a controlled manner in a distillation column.

ii) **Hydrotreating and Hydro desulphurizing**

The product streams that are produced in the distillation process have sulphur compounds imbedded in them with the concentration increasing from gas having the least and residue having the most sulphur content. The global trend is moving towards a reduction in sulphur content in all petroleum products. It is therefore necessary to reduce the sulphur content in the product streams.

For naptha and kerosene streams sulphur removal is achieved in a catalyst reactor operating above 300°C and in the presence of hydrogen gas at 20 bar pressure.

Similarly, sulphur is removed from gas oil by a similar chemical reaction but this is a more difficult process and higher temperatures and pressures are required to achieve the desired result. These units are generally more expensive when compared to similar facilities for treating naptha or kerosene.

iii) **Reforming**

This process is used to convert straight chain molecules present in naptha to aromatic type of molecules which have better properties suitable for use in petrol engines. The conversion is achieved in a platinum catalyst reactor operating at 500°C and moderate pressure.

iv) **Residue Conversion (Cracking)**

The distillation process results in residue yield ranging between 30-70% depending on the crude type. Residue has the least price in the market compared to crude and the other products. Generally, a higher residue yield from a refinery results in reduction in the refinery margin. Consequently, to improve their profitability modern refineries will have a process that will crack the residue and produce the higher valued products i.e. gas, naptha, kerosene and diesel. The molecules in the residue are difficult to crack and require high temperatures and pressures to achieve the desired result. Different technologies exist and they include hydrocracking, catalytic cracking and vis breaking. Sometimes these are used in combination. The selection is dependent on the type of residue and the desired final product mix.
v) Support facilities

Refineries require support facilities such as boiler water treatment facilities, boilers for steam generation, storage tanks, laboratories and effluent treatment facilities.

1.3.1 The Global Refining Industry Perspective

Traditionally global refineries have been large and fewer, most of these set up more than 30 years ago. The industrial countries delay from building new refineries suggests that the refining industry will go back to the locations of the crude oil production, in the producing nations. The move will help these nations in playing a bigger role in the global market.

The Asia Pacific region will experience the highest rate of product demand growth. The region’s share of global demand is projected to increase to 30 percent by 2015.

Some new refinery projects are being undertaken in Asia and the Middle East. China’s largest refiner, Sinopec, recently announced that it signed a joint venture refinery expansion project with Exxon Mobil and Saudi Aramco that will triple the capacity at its Quangang refinery to 240,000 bpd by 2009. China National Petroleum Corporation also plans to build a 1.3 million bpd refinery in Pengzhou which will be the largest refining project in China by 2010.

India plans to expand its refining capacity by at least 58 percent by 2012. India’s largest refinery, Jamnagar, with a capacity of 660,000 bpd, is in the process of doubling its capacity. Reliance Petroleum is currently constructing a second facility at the Jamnagar site, which is expected to have a capacity of 580,000 bpd when completed in 2008. Indonesia plans to bring 300,000 bpd of additional refining capacity online in 2009 while South Korea is planning a joint venture project with Saudi Aramco for a 440,000 Bp/d refinery projected to begin operations in 2010-2013.

The largest incremental growth in refinery capacity is planned for various Middle East refineries with over 2.3 million bpd of new refinery capacity expected online by 2011. However, recent cost issues have raised concerns as to whether or not these planned refineries can be built given current market conditions. Most of the newer refineries have advanced upgrading capabilities and cost upwards of US$ 5 billion. Kuwait recently reissued their tender for construction of a new 615,000 bpd refinery when construction bids came in at over US$6.3 billion.
Table 1: Global crude refining capacities

<table>
<thead>
<tr>
<th>Region</th>
<th>No. of refineries</th>
<th>Average crude distillation (barrels per day)</th>
<th>Catalytic reforming</th>
<th>Cracking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>50</td>
<td>70,000</td>
<td>15%</td>
<td>7%</td>
</tr>
<tr>
<td>Asia</td>
<td>165</td>
<td>130,000</td>
<td>9%</td>
<td>14%</td>
</tr>
<tr>
<td>Eastern Europe</td>
<td>94</td>
<td>110,000</td>
<td>15%</td>
<td>9%</td>
</tr>
<tr>
<td>Middle East</td>
<td>46</td>
<td>145,000</td>
<td>10%</td>
<td>6%</td>
</tr>
<tr>
<td>South America</td>
<td>69</td>
<td>98,000</td>
<td>7%</td>
<td>20%</td>
</tr>
<tr>
<td>Western Europe</td>
<td>105</td>
<td>142,000</td>
<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td>North America</td>
<td>160</td>
<td>130,000</td>
<td>20%</td>
<td>32%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>689</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Shell, 2007

1.3.2 African Refining Outlook

Prior to 1954 there were no refineries in Africa. All refined products were supplied to Africa from European and American refineries. For many years, Shell and Mobil managed a supply programme for all the marketers operating in West Africa. Under this programme, each month Shell arranged a ship from Curacao refinery, and Mobil arranged a ship from the UK. All marketers would request the quantities of each product they needed, and the ship would make a “milk run” along the coast. There was a similar arrangement in East Africa.

In the 50 years between 1954 and 2004, 48 refineries were built in Africa. In 1954 the first African refineries were built in Algiers (CFP/Total) and Durban, South Africa (Socony/Mobil). These were followed by the building of Luanda refinery (Petrofina) in 1958, and refineries in Kenya (Shell/BP), Ghana (ENI/Agip), and Senegal (consortium), in 1963. In the 1960’s refineries were also built in Cote d’Ivoire, Gabon, Tanzania, Nigeria (Port Harcourt I), and Capetown. South Africa In the 1970’s, following nationalisation of the oil industry in many countries, several state controlled refineries were built, such as Arzew in Algeria, Warri in Nigeria, CORAF in Congo, and SoNaRa in Cameroon. A final burst of refinery building took place in the 1980’s, including refineries at Warri and Port Harcourt in Nigeria. Whilst there have been a number of modernisation projects since then, the only new refineries built in the past 10 years have been Khartoum in 2001, and MIDOR in Egypt in 2002.
Even whilst refineries were being built, others were already being closed. In 1966 the Zimbabwe refinery closed due to sanctions imposed during the UDI period. Between 1980 and 2003 a further 10 uneconomic refineries closed permanently, among them the Dar es Salaam refinery, which was closed in 1999.

All the refineries are basically of the topping/reforming type, except for the four refineries in South Africa, two in Egypt, three in Nigeria, one in Cote d'Ivoire, and one in Ghana. There are also three Synfuel plants (coal and gas feedstock) in South Africa. The total active distillation capacity for the continent is around three million barrels per day (15 million MT/yr), an average of 79,000 bpd per refinery.

Table 2 below gives the existing refineries in Africa, while Figure 1 presents their location on the African map.
### Table 2: Existing Refineries in Africa

<table>
<thead>
<tr>
<th>Location</th>
<th>Refinery Name</th>
<th>Type</th>
<th>Owner/Operator</th>
<th>Capacity ('000 Barrels/Day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>Algiers Refinery</td>
<td>Simple</td>
<td>Sonatrach</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Arzew Refinery</td>
<td>Simple</td>
<td>Sonatrach</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Hassi Messaoud Refinery</td>
<td>Simple</td>
<td>Sonatrach</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Skikda Refinery</td>
<td>Simple</td>
<td>Sonatrach</td>
<td>300</td>
</tr>
<tr>
<td>Angola</td>
<td>Total Fina Petroleos de Angola</td>
<td>Simple</td>
<td>TOTAL, Fina Petroleos de Angola S.A.R.L., SONANGOL</td>
<td>45</td>
</tr>
<tr>
<td>Cameroon</td>
<td>SoNaRa (Société Nationale de Raffinage)</td>
<td>Simple</td>
<td>Total, Exxon Mobil, Shell, Government of Cameroon, Burkina Government</td>
<td>45</td>
</tr>
<tr>
<td>Congo</td>
<td>Coraf Refinery</td>
<td>Simple</td>
<td>Government of Congo</td>
<td>21</td>
</tr>
<tr>
<td>Cote d’Ivoire</td>
<td>SIR Refinery</td>
<td>Complex</td>
<td>Total, Shell, Exxon Mobil, ChevronTexaco, PETROCI</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Société Multinationale des Bitumes (SMB)</td>
<td>Bitumen</td>
<td>Shell, Société Ivoirienne de Raffinage, Bourse des Valeurs d’Abidjan</td>
<td>9</td>
</tr>
<tr>
<td>Egypt</td>
<td>Amerya Refinery</td>
<td>Simple</td>
<td>Egyptian General Petroleum Corporation</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>Asyut Oil Refinery</td>
<td>Simple</td>
<td>Egyptian General Petroleum Corporation</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td>Cairo Refinery Co - Mostrod</td>
<td>Simple</td>
<td>Egyptian General Petroleum Corporation</td>
<td>145</td>
</tr>
<tr>
<td></td>
<td>Cairo Refinery Co - Tanta</td>
<td>Simple</td>
<td>Egyptian General Petroleum Corporation</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>El Mex Refinery</td>
<td>Simple</td>
<td>Egyptian General Petroleum Corporation</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>El Suez Refinery</td>
<td>Complex</td>
<td>Egyptian General Petroleum Corporation</td>
<td>99.3</td>
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<tr>
<td></td>
<td>Suez Petroleum Processing Co Ref</td>
<td>Simple</td>
<td>Egyptian General Petroleum Corporation</td>
<td>66.4</td>
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<tr>
<td></td>
<td>MIDOR Refinery</td>
<td>Complex</td>
<td>Middle East Oil Refinery Company, Alexandria</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Wadi Feran Refinery</td>
<td>Simple</td>
<td>Egyptian General Petroleum Corporation</td>
<td>7</td>
</tr>
<tr>
<td>Gabon</td>
<td>Sogara Refinery - Gabon</td>
<td>Simple</td>
<td>TOTAL, ExxonMobil, Shell, Agip, Government of Gabon</td>
<td>21</td>
</tr>
<tr>
<td>Location</td>
<td>Refinery Name</td>
<td>Type¹</td>
<td>Owner/Operator</td>
<td>Capacity ('000 Barrels/Day)</td>
</tr>
<tr>
<td>----------</td>
<td>----------------------------------</td>
<td>-------</td>
<td>--------------------------------------------------------------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>Ghana</td>
<td>Tema Refinery</td>
<td>Complex</td>
<td>Ghana National Petroleum Corporation</td>
<td>43</td>
</tr>
<tr>
<td>Libya</td>
<td>Azzawiya</td>
<td>Simple</td>
<td>Government of Libya</td>
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<tr>
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<tr>
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<td>Sirte Oil Co</td>
<td>Simple</td>
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<td>Government of Zambia, TOTAL</td>
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</table>

**TOTAL REFINING CAPACITY** 3,017.7

Notes: 1. Simple - refinery without residue conversion( cracking) facility
2. Complex – refinery with residue conversion( cracking) facility
The major refining centres in Africa are in South Africa, Nigeria, Egypt and Algeria. The largest refinery in Africa is the Skikda refinery in Algeria (300,000 bpd), the second largest being the Ras Lanuf plant in Libya (220,000 bpd). In Sub Saharan Africa the largest are the Port Harcourt Refinery I and II in Nigeria (210,000 bpd), and the Shell/BP Sapref refinery in Durban (165,000 bpd).

Excluding some specialty plants (remote locations, bitumen) the smallest operating refinery is the 14,000 bpd Solimar refinery in Madagascar, which operates only occasionally. There are several small 20,000 bpd refineries including Sogara in Gabon, Indeni in Zambia, SAR in Senegal and CORAF in Congo.

i) **South Africa** has four refineries and three synfuels plants:

- Caltex has a 5.5 million MT/yr (110,000 bpd) refinery in Cape Town.
- Shell and BP have joint ownership of the 8.2 million MT per annum (165,000 bpd) Sapref refinery in Durban.
- Engen has the 6 million mt/yr (125,000 bpd) Enref refinery in Durban.
- Sasol and Total have joint ownership of the 4.2 million MT/yr (85,000 bpd) Natref refinery in Sasolburg.

All the South African refineries have undergone major expansion and upgrading since 1990.

ii) **Nigeria** has three refineries, all owned by the Nigerian National Petroleum Company:

- Kaduna refinery in northern Nigeria was built in 1980 with a capacity of 5.5 million MT/yr (110,000 bpd). A lube baseoil plant was added in 1982, and an LAB plant in 1987.
- Warri refinery in the south central region was built in 1978 with a capacity of 6.2 million MT/yr (125,000 bpd). A Carbon Black plant and a Polypropylene plant were added in 1986.
- Port Harcourt refinery in the southeast is made up of two refineries, built in 1965 and 1989. In 1993 they were merged into one, with a total capacity of 10.5 million MT/yr (210,000 bpd). The Eleme Petrochemical plant, which was built adjacent to the Port Harcourt refinery in 1995, has an olefin production capacity of 483,000 MT/yr, a polypropylene capacity of 80,000 MT/yr and a polyethylene production capacity of 250,000 MT/yr.

The Nigerian oil industry has been impacted seriously by operational problems during recent years, and production has been below 50% of capacity.

iii) **Egypt** has nine refineries mostly concentrated in the northeast (Cairo, Alexandria, Suez):

- El Mex refinery in Alexandria is operated by the Alexandria Petroleum Company. It has a capacity of 100,000 bpd, and 22,500 bpd of vacuum distillation capacity. In addition it has a lube baseoil manufacturing plant and a bitumen unit.
- Cairo Petroleum Refining Company in Mostorod, near Cairo. This refinery has a capacity of 145,000 bpd.
- The El-Nasr Petroleum Company near Suez has a capacity of 99,300 bpd. It has a 35,000 bpd Hydrocracker and a Bitumen unit.
- The Amiriyah Petroleum Refining Company in Alexandria has a capacity of 78,000 bpd, and a 15,000 bpd vacuum distillation unit. It has a 9,000 bpd Alkylation unit, and a 2,000 bpd lube baseoil manufacturing unit.
- The Suez Petroleum Processing Company near Suez has a capacity of 66,400 bpd, and a 9,500 bpd vacuum distillation unit. It
has a 16,400 bpd Delayed Coker, and a 1,000 bpd lube baseoil unit.

- The Asyut Petroleum Refining Company near the center of Egypt has a capacity of 47,000 bpd. This simple refinery has a small Naphtha Reformer, and is designed to supply product to the central and southern regions.
- The Tanta refinery near Port Said is operated by the Cairo Petroleum Refining Company. It has a capacity of 35,000 bpd. Other than a small Hydrotreating unit it has no upgrading capacity.
- The El-Nasr Petroleum Company operates the small Wadi Feran refinery on the Red Sea in the Gulf of Suez. It has a capacity of 7,000 bpd, and was designed to service operations related to the Suez Canal.
- The MIDOR was completed in 2002 in the Amiriyah Free Zone, Alexandria. It has a capacity of 100,000 bpd, and has a 35,000 bpd Hydrocracker, a 22,800 bpd Coker, and a 10,700 bpd Isomerisation unit. This is the only privately owned refinery in Egypt. It was originally a joint Egyptian/Israeli venture, but the Israeli shareholders sold out to the Egyptian National Bank in 2001.

iv) **Algeria** is major refining centre with four refineries:

- Algiers refinery, built in 1964, has a capacity of 60,000 bpd. It was built by CFP/Total to supply the main market. It has no cracking capacity, and no special units.
- Arzew refinery, built in 1973, has a capacity of 60,000 bpd. It was built by Sonatrach as an export refinery. It has no cracking facilities, but has Lube Baseoil (built 1984), and Bitumen units.
- Skikda refinery, built in 1980 (expanded in 1993), has a capacity of 300,000 bpd. It was built by Sonatrach as an export refinery and petrochemical complex. It has no cracking facilities, but has an Aromatics unit (BTX) and a Bitumen plant.
- Hassi Messaoud, a small refinery in southern Algeria, built in 1960, and expanded in 1979, has a capacity of 30,000 bpd.

### 1.4 The Existing Refinery in East Africa, the Kenya Petroleum Refineries Limited

#### 1.4.1 Overview

The Kenya Petroleum Refineries Limited (KPRL) is the only refinery in East Africa. It has an installed capacity of 3.2 million tonnes per year (70,000 bpd) but currently processes 1.6 million tonnes per year. KPRL produces 30,000 tonnes of LPG annually. It commenced producing unleaded gasoline in January 2006 as required by the Dakar Declaration.
There are plans to install a residue thermal cracking unit and diesel desulphurization facility to improve efficiency. This will enable the throughput to be raised from 1.6 million tones to 3.2 million tonnes per year and also increase the production of LPG from the current 30,000 tonnes to 110,000 tonnes. KPRL currently receives parcels of 80,000 tonnes of crude oil due to limitations of the harbour. Plans are underway to dredge the harbour to allow for ships with up to 150,000 tonnes capacity.

1.4.2 Contractual Framework

Ownership
KPRL was incorporated in 1960 with Shell and BP being the original owners each holding 50% of the equity. The shareholding structure has changed over the years with the entry and exit of some shareholders. The current situation is that the Government of Kenya holds 50% of the shareholding while the balance is held by three multinational companies namely Shell, BP and Chevron. A shareholders agreement exists between the Government and the various industry share holders. The multinationals have announced their intention to divest from KPRL and are in the process of actively marketing their equity. Several companies based in Africa, Europe and India have expressed interest in acquiring the stake.

Technical
KPRL has a long standing agreement with a technical department within Shell. This agreement enables KPRL to obtain support in the areas of plant operation, maintenance as well as manpower training and development. Through the same arrangement KPRL is able to benchmark its performance against 50 other refineries and also obtain best industry practices in the areas of plant operation, maintenance and Health, Safety and Environment (HSE).

Commercial
KPRL is a tolling refinery that earns revenue by charging a fee for processing crude oil for its customers. KPRL does not own the crude oil or the products. These are owned by the marketing companies who are the importers of the crude oil. Processing agreements have been entered into between KPRL and all its customers.
2 UPSTREAM PETROLEUM INDUSTRY IN EAST AFRICA

This Chapter discusses the policy, legal, regulatory and institutional framework for the upstream petroleum industry in each Partner State. In addition, exploration as well as development and production activities are discussed.

2.1 Policy, Legal and Regulatory Framework

2.1.1 Kenya

Policy
The objective of the Government is to enhance the enabling environment through which petroleum exploration and associated resources development activities can be undertaken in an environmentally sound manner. As part of its strategy to improve the enabling environment in order to advance the timing for undertaking drilling activities by the private sector, Government will carry out the minimum needed exploration works in areas designated for licensing. It is expected that this effort will minimize financial risks and therefore help to attract more oil prospecting companies.

Legal and Regulatory Framework
Upstream petroleum activities are governed by the Petroleum Exploration and Production Act, which was enacted in 1982.

Institutional Framework
The role of the Ministry of Energy in the upstream petroleum industry is to facilitate other actors by creating the appropriate policy and regulatory environment towards promoting exploration and exploitation of petroleum. The National Oil Corporation of Kenya (NOCK), a wholly government owned company.

2.1.2 Uganda

Policy
The Energy Policy for Uganda, 2002, provides a general framework for the development and use of all energy resources including petroleum. The main policy goal is to meet the energy needs of Uganda’s population for social and economic development in an environmentally sustainable manner.

Following discovery of oil and gas in the Albertine Graben, a more enhanced policy to govern the exploration and production of oil and gas has been approved.
Legal and Regulatory Framework
The Petroleum Exploration and Production Act Cap 150, 2000, governs the operations and development of the upstream petroleum sector. The function of regulation is vested in the Minister responsible for petroleum exploration and production. This law is being amended to comply with the new policy.

Institutional Framework
The Ministry of Energy and Mineral Development is responsible for the implementation of the Petroleum Exploration and Production Act Cap 150, 2000. A review is being carried out to address gaps that exist in the current institutional framework. A Petroleum Authority to regulate upstream activities is proposed under the new Oil and Gas policy.

2.1.3 Tanzania

Policy
The overall policy objective as outlined in the National Energy Policy, 2003 is to ensure availability of reliable and affordable energy supplies and their use in a rational and sustainable manner in order to support national development goals. The national energy policy, therefore, aims at establishing efficient energy production, procurement, transportation, distribution and end-use systems in an environmentally sound and sustainable manner. The policy recognizes the need to promote regional and international co-operation in exploration, development of infrastructure, trade, database and capacity building. The policy also gives directives on environmental issues pertaining to petroleum.

Legal and Regulatory Framework

There have been discoveries of natural gas and legislation to administer the use of natural gas is being developed

Institutional Framework
The major institutions for the Petroleum sector in Tanzania are the Ministry of Energy and Minerals, Tanzania Petroleum Development Corporation, Fair Competition Commission, Energy and Water Utilities Regulatory Authority (EWURA), TIPER and TAZAMA Pipelines Limited.
The Minister in charge of energy matters is responsible for policy formulation and granting of development license for exploration. TPDC is a public Corporation and its functions include carrying out the business of prospectors, producers, refiners, storage users and distribution of petroleum. EWURA deals with regulating water and energy sectors.

### 2.1.4 Burundi

**Policy**
The Ministry of Water, Energy and Mines is responsible for policy and regulation of the energy sector in Burundi.

The Presidential decree No. 110/314 of 14th November 2007 defines the principle objective of the Ministry of Water, Energy and Mines. In particular, the Minister in charge is responsible for elaborating and executing the national policy in the energy sector. The responsibilities include:
- To plan, control and coordinate all programmes and activities of the energy sector;
- To promote exploration and exploitation of hydrocarbons while protecting the environment;
- To enhance access to modern energy services at least cost; and
- To elaborate laws and regulations for the best management of the sector.

**Legal and Regulatory Framework**
The Presidential decree No. 110/314 of 14th November 2007 governs upstream petroleum activities.

**Institutional Framework**
The Ministry of Water, Energy and Mines is responsible for contracting private companies undertaking upstream petroleum activities.

### 2.1.5 Rwanda

**Policy**
A National Energy Policy was approved by the Cabinet in 2004. The goal of the policy is to meet the energy challenges and needs of the Rwandan population for economic and social development in an environmentally sound and sustainable manner. There is a steering committee to review and prepare a new policy and legal framework to govern the petroleum industry in Rwanda.

**Legal and Regulatory Framework**
The Government of Rwanda obtained financial support from the World Bank to finalize a gas law. The draft law is awaiting consideration for approval by Cabinet. The environmental management is governed by the
Environmental Act No. 19/2005 of 8th April 2005 and law No. 16/2006 of 3rd April 2006 which established Rwanda Environmental Management Authority.

**Institutional Framework**
The Ministry of Infrastructure is responsible for policy formulation while the Rwanda Utility Regulatory Agency, which was created by law No. 39/2001 of 13th September 2001, is responsible for regulation. The Ministry of Infrastructure is also responsible for upstream petroleum activities.

### 2.2 Exploration Activities in Partner States

#### 2.2.1 Kenya

Kenya has 4 sedimentary basins, namely the Lamu Embayment, the Anza Graben, the Mandera Basin and the Tertiary Rift Basins, all of which are areas with potential for oil and gas exploration. Oil exploration in these basins has been going on sporadically since the early 1950’s and to date, 31 exploration wells have been drilled in these basin. Almost all of these wells have had oil and gas shows but no commercial discovery has so far been made.

During the current phase of exploration that started in the year 2000, thirteen companies have taken up acreage in offshore Kenya and a total of 16,490 km of 2D seismic data has been acquired. Woodside Energy has drilled one deep offshore well, Pomboo-1 in 2200 m of water. The well did not encounter any hydrocarbons. In 2006, the Minister for Energy gazetted new exploration blocks in the country, with many blocks being subdivided into smaller acreages. The recent Ugandan discoveries in the Albertine Graben have made exploration acreage in rift settings very popular with oil exploration companies. This increase level of exploration activity significantly increases the chances of making a commercial discovery of oil or gas or both.

Currently, 9 companies hold licenses on exploration acreage in Kenya. In the next 4 years during which well drilling commitments on all the contracts will mature, a total of 9 wells are expected to be drilled in Kenya.

#### 2.2.2 Uganda

Appraisal drilling and gathering of two and three dimensional seismic data is ongoing to quantify the reserves of discoveries of oil and gas. The crude oil discovered so far in Uganda is light, sweet and waxy. Because of the wax, it has a high pour point, which implies that it would need to be transported in a heated pipeline. Current estimates indicate that there might be reserves of 500 million barrels and it is estimated that production of about 150,000 barrels per day could be achieved within five years. One
well showed 14 mm/scfd of natural gas indicating that there could be natural gas reserves.

2.2.3 Tanzania

Currently, Tanzania has signed Petroleum Sharing Agreements (PSA) with 11 International Exploration Companies (for 20 active licenses) which are now carrying out exploration activities in different areas at different stages (drilling of wells, collection and interpretation of data, etc) in offshore and onshore. Negotiations with two International Exploration Companies are in progress and 8 Blocks have been advertised.

So far, no crude oil discovery has been made, though indications from drillings and seismic data show that there might be potential reserves.

The Mkuranga field was discovered in 2007 and the well tested a stable rate of 19.2 mm/scfd. More wells are planned to delineate the field and determine gas reserves. Kiwalani North field was discovered in 2008 and appraisal work is underway to establish the size of the reserves.

2.2.4 Burundi

Some studies show that there could be some petroleum deposits in Lake Tanganyika and Ruzizi plains though the quantities and quality are not confirmed.

2.2.5 Rwanda

One of the strategic actions spelt out in Rwanda’s energy policy to address upstream issues in the petroleum sector, is to undertake exploration to ascertain the presence or absence of oil reserves in the country. In pursuit of the above mentioned strategy, an agreement has been signed between the Government of Rwanda and Vangold Resources Ltd for carrying out a hydrocarbon potential technical evaluation over north and western Rwanda. Vangold Resources Ltd will conduct a detailed study of the area to identify all areas of greatest prospective interest. An aero-magnetic survey will be conducted over a period of 18 months.

Straddling the border of Rwanda and DR Congo, Lake Kivu (2400 sq km) contains a huge deposit of natural gas, dissolved in its deep waters. While the gas reserves are estimated at 55 billion cubic meters of methane gas and other gases, recoverable reserves are estimated to be 39 billion cubic meters. The gas presents a huge potential, capable of contributing to the energy needs of the Great Lakes region.
2.3 Development and Production

2.3.1 Kenya

There are no development and production activities going on in Kenya at the moment.

2.3.2 Uganda

Following recent discoveries of oil and gas, plans have commenced to put up a topping plant with a capacity of 4000 barrels per day. Fuel oil will constitute the bulk of the output and will be utilized in generation of electricity to meet current shortage while the small volumes of kerosene and diesel will be offloaded into the local market. Since one well showed 14 mmscfd of natural gas indicating that there could be natural gas reserves, it is necessary that the generation plant should be dual-fired using both heavy fuel oil and natural gas. The procurement process for the early production scheme including the topping up plant, processing facilities and power plant has commenced. Production of petroleum products is expected to commence in the last quarter of 2009 while power generation is expected to commence in the first quarter of 2010.

2.3.3 Tanzania

Songo Songo
The field was discovered in 1974 and so far 10 wells have been drilled, five of which have been producing gas since 2004 at about 60 mmscfd. The recoverable reserve is estimated to be 0.850 tcf and most of the gas produced is used for power generation and as fuel in industries. Further drilling in Songo Songo north and west structures may provide additional reserves of 1 tcf.

Mnazi Bay
The field was discovered in 1982 and so far four wells have been drilled and are producing gas. Drilled and proven reserves amount to 420 bcf although total possible reserves are about 1.8 tcf. The gas field was initially developed for power generation but feasibility studies for other options of gas utilization are being undertaken. The current average production of 0.7 mmscfd is used for power generation of about 3.5 MW at Mtwara Power Station.

2.3.4 Burundi

There are no development and production activities going on in Burundi at the moment.

2.3.5 Rwanda

There are no development and production activities going on in Rwanda at the moment.
3  DOWNSTREAM PETROLEUM INDUSTRY IN EAST AFRICA

This Chapter discusses the policy, legal, regulatory and institutional framework for the downstream petroleum industry in each Partner State. The oil and gas market and existing infrastructure are also discussed.

3.1 Policy, Legal and Regulatory Framework

3.1.1 Kenya

Policy
The Government policy is to ensure provision of adequate supply and distribution of petroleum products in all parts of the country at least cost. The Government recognizes that regional imbalances in supply of petroleum fuels may equally promote disparities in the level and pace of socio-economic development. Critical to the success of this policy is the availability of storage, distribution and fuel-dispensing facilities within close proximities, to guarantee access to fuel, while at the same time maintaining high quality standards of these facilities and products to protect consumer interests and the environment.

Legal and Regulatory Framework
The Energy Act was passed in 2006 and came into effect in July 2007. Article 4.(1) of the Act establishes the Energy Regulatory Commission to be responsible for regulating the entire energy sector. Article 80.(1) addresses the licensing of downstream petroleum activities as business by setting a requirement that entities must conduct business in accordance with the terms and conditions of a valid license while Article 90.(1) covers the regulations in regard to construction permits. The Energy Act in Section 91.(1) (b) further emphasizes that the ERC will take into account other relevant government policies and legislations before licensing can be effected. These include but not limited to compliance with the Environmental and Management Co-ordination Act, 1999 that spells out Environmental (Impact Assessment and Audit) regulations 2003, the Physical Planning Act, 1996, the Kenya Bureau of Standards Act, and the Local Government Act among others.

Institutional Framework
The Minister for Energy is responsible for formulation of policies and laws relating to the energy sector. The Energy Regulatory Commission is the regulator while the Energy Tribunal is responsible for dispute resolution. KPRL operates a refinery in Mombasa which is co-owned by the Government of Kenya, BP, Shell and Chevron oil companies. The National Oil Corporation of Kenya (NOCK), wholly government owned company is involved in both upstream and downstream operations. The Kenya Pipeline Company (KPC) is a fully government owned company dealing in transportation and storage of petroleum products. The Kenya
Bureau of Standards is responsible for formulation and enforcement of Standards. There are over 30 licensed oil importing and marketing companies in the country.

3.1.2 Uganda

Policy
The Energy Policy for Uganda 2002 provides a general framework for the development and use of all energy resources including petroleum. The main policy goal is to meet the energy needs of Uganda’s population for social and economic development in an environmentally sustainable manner.

Legal and Regulatory Framework
The Government of Uganda enacted the Petroleum Supply Act 2003 to govern the operations and development of the downstream petroleum sector. The Act provides for the supervision, monitoring the importation and exportation of petroleum products, licensing and control of activities and installation for the safety and protection of public health and the environment in petroleum supply operations and installations as well as to encourage and protect fair competition in the market. The Act establishes the Minister responsible for the petroleum sector as the regulator. Other relevant legislations include National Environment Act 1995, and the Standards Act 1983.

Institutional Framework
The Ministry of Energy and Mineral development is responsible for the downstream petroleum sector. The Ministry is charged with the responsibility of policy formulation as well as regulation and monitoring of the sector.

3.1.3 Tanzania

Policy
The overall policy objectives as outlined in the National Energy Policy, 2003 is to ensure availability of reliable and affordable energy supplies and their use in a rational and sustainable manner in order to support national development goals. The national energy policy, therefore aims to establish an efficient energy production, procurement, transportation, distribution and end-use systems in an environmentally sound and sustainable manner. The policy recognizes the need to promote regional and international co-operation in exploration, development of infrastructure, trade, database and capacity building. The policy also gives directives on environmental issues pertaining to petroleum.
Legal and Regulatory Framework

The Petroleum (Conservation) Act, 1981 has been governing the operations in the sector but a new bill has been enacted by Parliament in April 2008. The new bill is designed to encourage competition and efficient usage of petroleum products. It sets clear the role of the regulator as far as economic, technical and safety issues are concerned. EWURA Act, 2003, governs the regulation functions of the Energy and Water Utilities Regulatory Authority.

The Tanzania Petroleum Development Corporation (TPDC) was established as a public entity under the Corporation Act, 1969. Its role includes carrying out the business of exploration, production, refining, storage and distribution of petroleum. Other relevant legislation include The Standards Act, 1975, Environment Management Act, 2004, Fair Competition Act, 2003 and Land Act, 1999 among others.

Institutional Framework

The Minister for Energy and Minerals is responsible for formulation of policy relating to the energy sector. The sector regulator is EWURA in matters relating to economic, technical and safety issues. TPDC’s role includes refining, storage and distribution of petroleum. Other institutions include the National Environment Management Council (NEMC), Fair Competition Commission, Tanzania Bureau of Standards, Oil Marketing Companies, TIPER and TAZAMA Pipelines Limited. There are over 40 licensed oil importing and marketing companies in the country.

3.1.4 Burundi

Policy
The energy sector including the downstream petroleum sub-sector is governed by the “politique sectionelle de ministere de l’energie et des mines” policy. As part of the policy, the downstream petroleum sub-sector is liberalized. Private operators import all the oil consumed in the country while the Government through the Ministry of Trade, by ministerial ordinance, fixes the price of oil products in consultation with all private operators.

Legal and Regulatory Framework
The Presidential decree No 110/314 of 14th November 2007 defines the principle objective of the Ministry of Water, Energy and Mines. The downstream petroleum sub-sector is governed by Trade Liberalization Law.
Institutional Framework
The Minister in charge is responsible for elaborating and executing the national policy in the energy sector including the petroleum sub-sector. The responsibilities are, among others:
- To plan, control and coordinate all programmes and activities of the energy sector in view of constructing infrastructure.
- To promote research in hydrocarbon and exploitation while protecting the environment
- To enhance access to modern energy services at least cost
- To elaborate laws and regulations for the best management of the sector

3.2 Oil and Gas Market

3.2.1 Regional Energy Mix

The energy sector in East Africa is dominated by petroleum and electricity as the prime movers of the modern sector of the economy, while wood fuel provides energy needs of the traditional sector including rural communities and the urban poor. At the national level, wood fuel and other biomass account for over 90% of the total primary energy consumption, followed by petroleum which accounts for 5% to 22%, electricity consumption accounts for between 1% and 9% while other sources account for less than 1%. Solar energy is also extensively used for drying. Table 3 shows the energy mix among the Partner States of EAC.

Table 3: Energy mix in the EAC Partner States

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<th>Tanzania</th>
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<td>100</td>
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</tbody>
</table>

Source: EAC Regional Strategy on Scaling Up Access to Modern Energy Services, 2006

3.2.2 Overview of Downstream Petroleum Market

The current demand for petroleum products in the East African region is estimated at 7.9 million MT per annum. Assuming that this demand will grow at the same rate as the GDP, the estimated demand will be 10.2 million MT by 2010, 14.1 million MT in 2015 and 19.5 and 27 million MT by 2025 and 2030, respectively. Table 4 shows the demand forecast under this scenario.
Table 4: Projected demand of petroleum products based on annual GDP growth rate

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<th>Country</th>
<th>Base line demand, 2006¹</th>
<th>Projected GDP growth rate²</th>
<th>2010</th>
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<tr>
<td></td>
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</tr>
<tr>
<td>Tanzania</td>
<td>1.7</td>
<td>7.5</td>
<td>2.3</td>
<td>3.3</td>
<td>4.7</td>
<td>6.7</td>
</tr>
<tr>
<td>Rwanda</td>
<td>0.2</td>
<td>4.6</td>
<td>0.2</td>
<td>0.3</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td>Burundi</td>
<td>0.1</td>
<td>5.8</td>
<td>0.1</td>
<td>0.2</td>
<td>0.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Eastern DRC</td>
<td>0.2</td>
<td>8.5</td>
<td>0.3</td>
<td>0.4</td>
<td>0.6</td>
<td>0.9</td>
</tr>
<tr>
<td>Southern Sudan</td>
<td>0.1</td>
<td>10.7</td>
<td>0.2</td>
<td>0.2</td>
<td>0.4</td>
<td>0.7</td>
</tr>
<tr>
<td>Malawi</td>
<td>0.6</td>
<td>5.2</td>
<td>0.7</td>
<td>0.9</td>
<td>1.2</td>
<td>1.6</td>
</tr>
<tr>
<td>Zambia</td>
<td>1.0</td>
<td>6.2</td>
<td>1.3</td>
<td>1.7</td>
<td>2.3</td>
<td>3.1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>7.9</strong></td>
<td></td>
<td><strong>10.2</strong></td>
<td><strong>14.1</strong></td>
<td><strong>19.5</strong></td>
<td><strong>27.0</strong></td>
</tr>
</tbody>
</table>

1. The baseline demand for DRC, Southern Sudan, Malawi and Zambia relate to the portion of demand supplied through the East African Partner States.

If the demand for petroleum products grows at half the GDP growth rates, the projected demand would be as given in Table 5 below. In this case, demand would be 9 million MT in 2010, 10.6 million MT in 2015, and 12.5 and 14.7 million MT in 2025 and 2030, respectively.

Table 5: Projected demand of petroleum products based on 50% of the annual GDP growth rate

<table>
<thead>
<tr>
<th>Country</th>
<th>Base line demand, 2006</th>
<th>Projected GDP growth rate</th>
<th>2010</th>
<th>2015</th>
<th>2025</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Million MT</td>
<td>%</td>
<td>Million MT</td>
<td>Million MT</td>
<td>Million MT</td>
<td>Million MT</td>
</tr>
<tr>
<td>Kenya</td>
<td>3.2</td>
<td>3.25</td>
<td>3.6</td>
<td>4.3</td>
<td>5.0</td>
<td>5.9</td>
</tr>
<tr>
<td>Uganda</td>
<td>0.8</td>
<td>3.25</td>
<td>0.9</td>
<td>1.1</td>
<td>1.3</td>
<td>1.5</td>
</tr>
<tr>
<td>Tanzania</td>
<td>1.7</td>
<td>3.75</td>
<td>2.0</td>
<td>2.4</td>
<td>2.8</td>
<td>3.4</td>
</tr>
<tr>
<td>Rwanda</td>
<td>0.2</td>
<td>2.3</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Burundi</td>
<td>0.1</td>
<td>2.9</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>DRC</td>
<td>0.2</td>
<td>4.25</td>
<td>0.2</td>
<td>0.3</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>Southern Sudan</td>
<td>0.1</td>
<td>5.35</td>
<td>0.1</td>
<td>0.2</td>
<td>0.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Malawi</td>
<td>0.6</td>
<td>2.6</td>
<td>0.7</td>
<td>0.8</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
<td>Zambia</td>
<td>1.0</td>
<td>3.1</td>
<td>1.1</td>
<td>1.3</td>
<td>1.5</td>
<td>1.8</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>7.9</strong></td>
<td></td>
<td><strong>9.0</strong></td>
<td><strong>10.6</strong></td>
<td><strong>12.5</strong></td>
<td><strong>14.7</strong></td>
</tr>
</tbody>
</table>
The downstream sector in the region is liberalized. The main suppliers of oil and gas market are private oil marketing companies.

In Kenya, the petroleum sector was liberalized in 1994 thereby allowing new entrants into the industry. An open tender system coordinated by the Ministry of Energy is used to import 100% of the crude oil and 70% of refined petroleum while the balance is imported by the individual companies.

In Uganda, the downstream sub-sector was liberalized in 1994 and by 1996; the government had completed divestiture of all its interests in the oil companies. The downstream operations of the petroleum sector in Tanzania were liberalized in the year 2000 whereby oil companies import products and market forces determine the price.

Importation, transport, storage and marketing of oil products in Rwanda is liberalized. However, prices are controlled by the Government through the Ministry of Commerce in consultation with Ministry of Finance, Ministry of Infrastructure and Rwanda Revenue Authority. Similarly, the market in Burundi is liberalized but pricing of oil products is controlled by Government through the Ministry of Trade in consultation with private sector players, the importers.

### 3.2.3 Liquefied Petroleum Gas

Liquefied Petroleum Gas (LPG) is one of the products obtained from the processing of crude oil. It is a very clean fuel because it has virtually no sulphur compounds and its usage reduces depletion of forests for woodfuel. Switching to LPG will eliminate problems associated with use of biomass fuel. The use of LPG is supported by governments, environmental, and development agencies for its socio-economic and environmental benefits.

In East Africa its usage is limited to the upper income earners in urban areas. Consumption of LPG has been held back by higher prices arising from supply and distribution constraints. Except for Tanzania the other Partner States rely on supplies from Mombasa. LPG for the Tanzanian market is mostly supplied through Dar es Salaam and a portion enters the northern part of Tanzania from Kenya. LPG in Tanzania is not taxed.

The demand for LPG in the Region was 62,000 tonnes in 2006. LPG consumption in Uganda, Northern Tanzania, Rwanda, Burundi and Southern Sudan is very low or non existent because of lack of supply. These regions view Mombasa as the natural source of LPG. Projected growth in the LPG demand is shown in Table 6 below. The demand is constrained by inadequate supply infrastructure, taxation and non standardization of regulators and bottles increasing switching costs for
consumers. LPG is also imported in small parcel sizes, which increases freight costs.

Table 6: Projected growth in the demand for LPG

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya</td>
<td>51,118</td>
<td>76,674</td>
<td>106,647</td>
<td>145,120</td>
<td>198,635</td>
</tr>
<tr>
<td>Uganda</td>
<td>3,949</td>
<td>7,854</td>
<td>15,619</td>
<td>30,306</td>
<td>58,804</td>
</tr>
<tr>
<td>Tanzania</td>
<td>9,000</td>
<td>13,500</td>
<td>20,250</td>
<td>30,375</td>
<td>45,563</td>
</tr>
<tr>
<td>Rwanda &amp; Burundi</td>
<td>5,451</td>
<td>7,557</td>
<td>10,702</td>
<td>15,050</td>
<td>21,460</td>
</tr>
<tr>
<td>Southern Sudan</td>
<td>106</td>
<td>123</td>
<td>143</td>
<td>165</td>
<td>192</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>69,624</strong></td>
<td><strong>105,708</strong></td>
<td><strong>153,361</strong></td>
<td><strong>221,016</strong></td>
<td><strong>324,654</strong></td>
</tr>
</tbody>
</table>

3.2.4 Natural Gas

Proven reserves for Songo Songo is 520bcf, daily production is 70mcf (63mcf for electricity and 7mcf for industries). The life time of the project is estimated to be 20 years from 2004.

Proven reserves for Mnazi Bay is 400bcf, daily production is 1mcf for electricity. The life time of the project is estimated to 20 years from year 2006.

These have an impact on the development of refineries in the sense that gas could be a substitute for heavy fuel oil for thermal power generation.

A feasibility study on the use of natural gas in vehicles, households, hotels and institutions in Dar es Salaam was carried out and the final report was submitted in 2007.

Financing is being sought to initially begin with a pilot project by 2008.

3.3 Existing Infrastructure

There are two main routes for distribution of products in the region: the northern and southern corridors.

3.3.1 The Northern Corridor

The northern corridor covers supply of products to Kenya, Uganda, Rwanda, Burundi, Eastern DRC and Southern Sudan through the Mombasa port. This corridor relies on one oil jetty, the Kipevu Oil Jetty. The maximum ship size that can enter the port is 80,000 MT due to depth constraints at the port entrance of maximum draught of 13.25m. There are plans to build a second jetty and to dredge the port to allow ships with up to 150,000 MT capacity.
The oil industry in Kenya uses an open tender system to import 100% of the crude oil and 70% of refined petroleum products into the country while the balance is imported by the individual companies. The crude oil is refined at the KPRL, which has an installed capacity of 3.2 million tonnes per year, but currently processing 1.6 million tonnes per year. KPRL currently processes Murban and Arab Medium crude oils from United Arab Emirates and Saudi Arabia respectively. There are plans to install a residue thermal cracking unit and diesel desulphurization facility to improve efficiency. This will raise the throughput from 1.6 million tonnes to 3.2 million tonnes per year and increase the production of LPG from the current 30,000 tonnes to 110,000 tonnes per year. The project is estimated to be completed by 2011.

The imported refined products are first received into the Kipevu Oil Storage Facility (KOSF), owned and operated by the KPC, with a total storage capacity of 300,000 MT, before being transported through the KPC pipeline. The refined oil products from KPRL are also distributed through the pipeline while part of it is sold directly into the local market for the coast region. LPG, fuel oil and bitumen from the refinery are transported by road and rail.

The pipeline runs from Mombasa through Nairobi, Nakuru, Eldoret and Kisumu where there exists storage facilities. From the depots, trucks are used to transport the products to various destinations within the Kenya. Oil products to the rest of the region are collected from Eldoret and Kisumu depots and transported by road. Currently, the pipeline is experiencing constraints due to increased demand which exceeds its pumping capacity. However, a capacity enhancement programme is underway to double the flow rate for the line from Mombasa to Nairobi from 440m$^3$ to 880m$^3$ per hour. In addition, a feasibility study for a parallel line from Nairobi to Eldoret is ongoing. A project to extend the pipeline from Eldoret to Kampala is underway and the construction phase is expected to commence in mid 2008, and be commissioned by mid 2009. There is a proposal to extend the oil pipeline from Kampala to Kigali and Bujumbura after the completion of Eldoret-Kampala pipeline project.

The storage capacity for depots strategically located in different parts of Kenya is shown in table 7 below.
Table 7: Storage capacity in Kenya

<table>
<thead>
<tr>
<th>Depot</th>
<th>Capacity (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KPRL</td>
<td>520,022</td>
</tr>
<tr>
<td>KPC Storage:</td>
<td></td>
</tr>
<tr>
<td>• Kipevu Oil Storage Facility (KOSF)</td>
<td>300,000</td>
</tr>
<tr>
<td>• Nairobi depot</td>
<td>97,000</td>
</tr>
<tr>
<td>• Nakuru</td>
<td>31,000</td>
</tr>
<tr>
<td>• Eldoret</td>
<td>42,000</td>
</tr>
<tr>
<td>• Kisumu</td>
<td>39,000</td>
</tr>
<tr>
<td>• Jomo Kenyatta International Airport</td>
<td>54,000</td>
</tr>
<tr>
<td>• Moi International Airport</td>
<td>6,800</td>
</tr>
<tr>
<td>Private owned storage in Mombasa</td>
<td>170,525</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,260,347</strong></td>
</tr>
</tbody>
</table>

In the Uganda, products are stored in independent oil depots which are located in Kampala, Jinja, Mbale and Kasese. The Government maintains storage facilities for strategic reserves located in Jinja. Storage capacity is 59,000 m$^3$ comprising of 30,000 m$^3$ government owned storage and 29,000 m$^3$ private sector owned. The Eldoret-Kampala pipeline project has a proposed storage component of 115,000 tonnes in Kampala.

There are five depots in Rwanda with a total storage capacity of 31,700 m$^3$: A feasibility study for a new storage facility of 70 000 m$^3$ in Kigali is planned to be carried out in 2008. The existing storage capacity in Rwanda shown in Table 8 below.

Table 8: Existing storage capacity in Rwanda

<table>
<thead>
<tr>
<th>Depot</th>
<th>Petrol (m$^3$)</th>
<th>Diesel (m$^3$)</th>
<th>Kerosene (m$^3$)</th>
<th>Fuel Oil (m$^3$)</th>
<th>Jet (m$^3$)</th>
<th>Total (m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gatsata (Kigali)</td>
<td>7,200</td>
<td>5,100</td>
<td>1,500</td>
<td>1,900</td>
<td></td>
<td>15,700</td>
</tr>
<tr>
<td>Kabuye (Kigali)</td>
<td>3,000</td>
<td>2,100</td>
<td></td>
<td></td>
<td></td>
<td>5,700</td>
</tr>
<tr>
<td>Bigogwe (Western Province)</td>
<td>3,000</td>
<td>2,000</td>
<td></td>
<td></td>
<td></td>
<td>5,000</td>
</tr>
<tr>
<td>Rwabuye (South Province)</td>
<td>1,900</td>
<td>1,900</td>
<td></td>
<td></td>
<td></td>
<td>3,800</td>
</tr>
<tr>
<td>Kanombe (Kigali Airport)</td>
<td></td>
<td></td>
<td>1,500</td>
<td></td>
<td>1,500</td>
<td>1,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15,100</strong></td>
<td><strong>11,100</strong></td>
<td><strong>1,500</strong></td>
<td><strong>2,500</strong></td>
<td><strong>1,500</strong></td>
<td><strong>31,700</strong></td>
</tr>
</tbody>
</table>

Most of the oil products in Burundi are imported through Mombasa while the rest are imported through Zambia via Lake Tanganyika. Existing Storage capacity is 32,000m$^3$ comprising 12,000m$^3$ in Bujumbura and 20,000m$^3$ in Gitega.
3.3.2 The Southern Corridor

The southern corridor covers supply of products to Tanzania, Uganda, Rwanda, Burundi and Eastern DRC through the Dar es Salaam port. Most of the refined petroleum products imported into Tanzania (85-95%) are transported by sea and discharged through the Kurasini Oil Jetty (KOJ) at the Dar es Salaam port. The balance is received at the port of Tanga and from Kisumu, Kenya via Lake Victoria and by road to Musoma, Mwanza and Bukoba.

The KOJ is limited to vessels carrying a maximum of 40,000 MT with a maximum draught of 11.5 meters. Due to uncoordinated small cargo imports of petroleum, there is congestion due to multiple ship arrivals. There are no modern jetties and discharge facilities at the lake ports. The Tanzania Ports Authority has done a feasibility study to modernize the Single Buoy Mooring (SBM) to a multi product discharge facility to ease congestion at KOJ and facilitate bulk imports for vessels carrying up to 120,000 MT of product.

The products are transported by road and rail. The central railway line runs from Dar es Salaam to Mwanza and branches at Tabora to Kigoma. From Kigoma to Bujumbura are products transported by road or barge across Lake Tanganyika. The line is also linked to Tanga, Arusha, Moshi and to Voi in Kenya. There are paved major roads linking Dar es Salaam to Mwanza, Musoma to Kenya, Moshi to Kenya and Mbeya to Malawi. Plans are underway to upgrade the road from Mwanza to Bukoba to Mutukula. The Mwanza road branches to Kahama to enter Rwanda. From Mwanza Port products to Uganda are transported by ferries and barges across Lake Victoria to Port Bell and Jinja.

The storage facilities in Tanzania are spread out in various locations that include Dar es Salaam, Tanga, Moshi, Arusha, Mwanza, Mbeya, Bukoba, and Dodoma among other towns. The current total storage capacity available in the country is 501,875 tonnes. Isaka is an inland port with a storage capacity of about 3,000 MT that could supply Rwanda and Burundi but the unreliability of the railway line from Dar es Salaam to Isaka has forced Rwanda and Burundi to rely on the northern corridor for their supplies. The ongoing rehabilitation of the storage tanks at the TIPER refinery, which closed in 1999 will avail additional storage capacity of 208,180 tonnes by 2009.
Table 9: Storage capacity in Tanzania

<table>
<thead>
<tr>
<th>Depot</th>
<th>Capacity (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dar es Salaam</td>
<td>394,353</td>
</tr>
<tr>
<td>Mtwara</td>
<td>6,704</td>
</tr>
<tr>
<td>Tanga</td>
<td>22,042</td>
</tr>
<tr>
<td>Moshi</td>
<td>3,296</td>
</tr>
<tr>
<td>Arusha</td>
<td>3,645</td>
</tr>
<tr>
<td>Isaka</td>
<td>3,000</td>
</tr>
<tr>
<td>Mwanza</td>
<td>18,305</td>
</tr>
<tr>
<td>Mbeya</td>
<td>6,336</td>
</tr>
<tr>
<td>Tabora</td>
<td>534</td>
</tr>
<tr>
<td>Mara</td>
<td>1,790</td>
</tr>
<tr>
<td>Bukoba</td>
<td>382</td>
</tr>
<tr>
<td>Dodoma</td>
<td>557</td>
</tr>
<tr>
<td>Shinyanga</td>
<td>3,144</td>
</tr>
<tr>
<td>Kigoma</td>
<td>14,889</td>
</tr>
<tr>
<td>Makambako</td>
<td>1,332</td>
</tr>
<tr>
<td>Coast</td>
<td>236</td>
</tr>
<tr>
<td>Malawi Government storage in Dar es Salaam and Mbeya</td>
<td>21,330</td>
</tr>
<tr>
<td><strong>Total-Tanzania</strong></td>
<td><strong>501,875</strong></td>
</tr>
</tbody>
</table>

3.3.3 Exports to Zambia and Malawi

There is one pipeline from Dar es Salaam to Ndola in Zambia which is used to transport crude oil to the Indeni refinery in Zambia. Currently spiked crude oil for Zambia is discharged through the SBM to the Tanzania and Zambia (TAZAMA) storage facility in Kigamboni area. The Tanzania Zambia Railway Authority (TAZARA) railway line from Dar es Salaam to Zambia is also used to transport products.

Products to Malawi are transported by road from Dar es Salaam through Mbeya.

3.3.4 Constraints and weaknesses of the current Infrastructure

a) KPRL operates at 1.6million tonnes utilization capacity out of the 3.2million tonnes potential. Planned upgrading is to push the throughput to full capacity. Existing storage at the refinery is planned for 3.2m tonnes. There is also a limitation on the quality of products processed at the refinery. Diesel produced at KPRL has a sulphur content of 1% i.e.
10,000ppm. The current East African standard is 0.5% and it is proposed that it should be reduced to 0.25%. The Kenya Pipeline System is currently under capacity despite operating at the maximum level. This has necessitated the loading of trucks from as far back as Mombasa instead of Eldoret and Kisumu as originally envisaged.

b) Roads, transnational roads and the roads of Mwanza-Bukoba and Mwanza Voi are in poor state occasioning inaccessibility or delayed delivery of products to would be destinations. The bad state of these alternative supply roads increase the turn around period of road tankers and consequently increase the costs of the delivered products.

c) The two railway systems from Mombasa to Kampala through Kisumu (northern route) and from Dar es Salaam to Mwanza (southern route) are inefficient. This inefficiency has disabled the ability of rail transportation to supplement the pipeline as a means of maintaining supplies of petroleum products to the region. Although both rail systems have been concessioned, their improvement is yet to be realized.

d) Changes especially those related to revenue collection and protection of dumping are noble. However, their poorly planned introduction in the past has in some occasions resulted in the disruption of the flow of products in the region and should in future be implemented through consultations within the EAC mechanisms.

Uganda, Rwanda and Burundi occasionally experience problems of supply due to inadequacy and logistical challenges within the supply system resulting into the current constrained demand. If the supply system was improved, demand could be greater than the current levels.
4 ANALYSIS OF THE CURRENT SYSTEM

4.1 SWOT Analysis

The objective of undertaking the SWOT analysis is to identify the gaps that exist in the current state which may enable or frustrate the implementation of the strategy and the realization of the strategy’s objectives.

4.1.1 Strengths

i) Discoveries of oil and gas in the region

There has been accelerated and significant petroleum upstream activities in the East African region. Partner States are undertaking numerous exploration activities in the various regions and significant discoveries have been realized. Tanzania has discovered gas in the Songo Songo basin, Mnazi Bay and Mkuranga production of which started in 2004.

Uganda has made oil discoveries in the Albert Graben. The discovery of the oil and gas in Uganda presents an opportunity to establish a refinery and production of oil products for the local market as well as export. More exploration work is being undertaken and Uganda is yet to firm up the reserves. It is hoped that more significant reserves will be discovered as exploration works continue. There are exploration activities in Kenya, in the Northern regions and Lamu areas, in the Lake Kivu areas in Rwanda and coastal areas and offshore of Indian Ocean in Tanzania. All these present a great potential of a strong oil and gas industry in the region.

ii) A growing regional market for oil and gas products.

The East African Community has five Partner States with a combined population of approximately 120 million. This big population presents a good market for petroleum products. Combined annual demand is estimated at eight million tonnes. Additionally the regional economies are fast growing at an average of 5% of GDP growth which is less than the Sub Saharan Millennium Development target of 7%. With relative political stability, these economies are likely to grow at even higher rates than the current levels. The Partner States are rigorously promoting industrialization of their economies. As the region industrializes the demand for petroleum products will increase supporting the development of oil and gas in the region.

Market for petroleum products is further enhanced by the growing demand for petro-chemical products e.g. fertilizers, packaging and pharmaceuticals. East African region is largely an agricultural region.
and with the promotion of agro industries and industrialization demand for petro chemicals will increase even further.

iii) Similar standards and product specifications

Unlike in other regions where neighboring countries may have different petroleum products specifications and standards, the Partner States of the EAC have a common set of standards. Indeed the common standards have facilitated importation of petroleum products into the region. With similar product specifications it has been easy for marketers to operate within the entire region, importing in bulk to supply the region the economies of scale due to large scale operations. With a common specification and standard, it is easy to supply petroleum products for the region and consequently easy for refineries to produce one product specification for the region.

iv) Common Language (English and Kiswahili)

The East African region has a common medium of communication i.e. a common language English. Although Rwanda and Burundi, unlike the other states which are Anglophone, were Francophone, English is widely spoken in these countries as well. In addition, Kiswahili is widely used in the Region. The common language facilitates trade and commerce and indeed is a great contributor to the East African cooperation.

v) Local human resource capacity

For over 48 years, the Kenyan Government together with private partners have operated a refinery in Mombasa. KPRL has been at the center of supplying petroleum products to not only Kenyan market but also to the entire region. In addition to processing petroleum products for the region, KPRL has helped in training and developing a critical mass of local human resource within the region. A number of professionals have undertaken training at the refinery in addition to a significant number having worked at the refinery accumulating the much needed refinery experience. Therefore the KPRL has helped in building a critical professional mass for refineries development in the region.

4.1.2 Weaknesses

i) Inadequate infrastructure

Probably the most challenging factor facing the East African petroleum market is the inadequate and sometimes inefficient infrastructure. Three of the five partner states are land locked, with only two states having a coastal line. Consequently petroleum products have to be moved through long distances by combination of pipelines, roads, water and railway system. This long supply chain presents numerous logistical challenges. The existing Mombasa-Eldoret oil products
pipeline the capacity can no longer match the fast growing regional demand. The railway systems are inefficient and cases of product losses are common. This, coupled with the long distance makes the railway very uncompetitive although one of the supply systems. Most of the roads infrastructure is in bad state and the turn around period of road tankers is long in addition to numerous breakdowns, insecurity and theft.

The inadequate and inefficient infrastructure has resulted into the high cost of transportation and distribution of petroleum products. Distribution by road has resulted in loss of life through accidents, damage to roads and environmental degradation when spillages occur.

ii) Inadequate legal and regulatory framework

One critical and inevitable requirement to facilitate economic progress is an appropriate legal and regulatory framework. It is observed that the Partner States are at different levels of developing their respective legal and institutional frameworks to facilitate and promote development of refineries. In addition there are non tariff barriers that impede quick movement of petroleum products within the region. All these are challenges that face the development of the petroleum sector in general and the refinery industry in particular for the region.

4.1.3 Opportunities

i) Global oil prices

Over the last three years, the world has witnessed a steady rise in the price of oil. Early January 2008 the oil price hit a record mark of $100 a barrel. Analysts predict that oil prices are less likely to reduce to their 1990 low levels. The high international prices however have offered an opportunity and great incentive for upstream investments as crude value has sharply risen. The high global oil prices have made exploration in marginal areas viable. Secondly, higher oil prices and increased global liquidity presents a good opportunity for refinery development.

ii) Emerging neighboring market- Eastern DRC, Southern Sudan, Malawi and Zambia:

Apart from the existing East African market of over 120,000 barrels per day crude oil equivalent, there is an emerging neighbouring market in the region. The Democratic Republic of Congo after several years of instability, peaceful developments have been realized. The peace that has now developed in the Eastern part of DRC presents a new emerging market. This area is supplied by the East Africa supply system and its growing demand is a great opportunity for refinery development in the region. Southern Sudan after years of civil war, a
peace agreement was signed in 2005. Since the signing of the Comprehensive Peace Agreement (CPA), the region is witnessing tremendous economic growth. This area is supplied through Kenya and Uganda and its growing economy provides an additional market to the East African petroleum market. Malawi and Zambia get part of their supplies through Tanzania. These economies are experiencing a steady growth presenting even greater opportunity for the East African oil industry.

iii) Regional Electricity Shortage.
Since 2004, the region has witnessed a dramatic change in the climatic conditions. This has greatly impacted on the region’s hydro power generating capacity. Presently the economies experience a shortage of electricity. The short term solution to the electricity crisis has been the introduction of emergency thermal power generation. Tanzania generates 194MW from thermal power plants. Uganda currently is generating 100MW of electricity from thermal power plants, and this is expected to reach 200MW by end of 2008. Kenya has 363MW of installed thermal plants and 90MW under construction. Rwanda has 27.3MW of thermal plants while Burundi has 5.5MW. Thus the total installed thermal plant capacity in the region is 689.8MW and is likely to reach 800MW by end of 2008. Currently, it is estimated that the region consumes approximately one million tones of fossil fuel for generating electricity, based on 700MW at 50% Load Factor and 0.32kg/kWh fuel consumption by thermal plants. It is predicated that there will be increased demand for thermal power, creating further demand for petroleum products. This presents an opportunity to the development of refineries. Even with the stability of the climate, thermal power generation is expected to remain a critical component of the regions energy mix.

4.1.4 Threats

i) Competition from the Middle East
The Eastern African petroleum products market is currently served by the Arab Gulf and Mediterranean markets, where many big refineries are located. In the recent past, refinery development has been aimed at increasing the efficiency of refineries. Refineries that are not efficient or are not able to cope with today’s requirements have either been closed down or decommissioned. The existing refineries in the Middle East have been expanded, increased their capacity and efficiency, refining products at very low rates and consequently supplying low cost products to the world markets including the East African market. Any refinery development in the region will therefore

\[
\text{FuelAmount(MillionTons)} = \left( \frac{700 \text{MW} \times 10^3 \text{ kW/MW} \times 8760 \text{ hr/yr} \times 0.32 \text{ kg/kWh} \times 50\%}{10^6 \text{ kg/ton} \times 10^6 (1/\text{million})} \right)
\]
have to face competition from the highly efficient refineries in the Middle East.

ii) Regional Instability

Although the East African region has been relatively peaceful, there have been numerous cases of instability depicting the level of fragility of the region. Civil wars and internal civil strife have occurred in some Partner States impeding the movement and distribution of petroleum products. There have also been cases of large scale terrorists' threats and attacks in the region. Petroleum infrastructure and distribution systems can be good targets for terrorists and civil strife and with the high levels of fragility and instability in the region; this can be a serious threat to the development of refineries and petroleum infrastructure in the region.

iii) Increasing Environmental Considerations

In the last decade the world has witnessed a growing demand for greater environmental protection due to increasing public health and safety requirements. Increased and developed environmental considerations have necessitated improvements in the production processes, high standards and specification to reduce environmental impacts of refinery processes. As the climatic changes continue unabated, the global movement for cleaner production will continue to press improved efficiency in production and reduction of emissions that damage the environment. If not well managed, oil can be a great polluter of the environment and any refinery development will have to comply to the stringent environmental requirements and standards of the world today.

iv) Mismanagement of Oil Revenues

The discovery of oil is usually celebrated as a source of wealth and economic growth. Many nations are now scouring the earth to uncover new sources of oil with a view it will thrust them into prosperity. But recent history shows that the presence of oil in a developing country makes life worse, not better, for most of its population. It is the poorest who pay the most to satisfy the growing thirst for fuel for the rich. In these economies, the revenues from oil have not been utilized to the benefit of the societies and communities. To the contrary, such countries have experienced numerous strife, revenue mismanagement, corruption and increased poverty, dashing the expectations of an oil boom and associated benefits. The environmental impacts of these discoveries and subsequent oil production on the lives of the poor are enormous. This has been termed the “oil curse”. Although a number of countries have experienced this oil curse, some countries however have shown that oil revenues could be better managed and utilized to improve the lives of its people. Therefore oil and refinery development will have to bear
in mind this “oil curse” syndrome and put in place appropriate mitigation measures.

v) Increasing prices of construction materials and services

The increase in the price of oil has seen a corresponding increase in the price of steel and copper which are extensively used in the construction of processing plants. An increase in prices of processing plants reduces the viability of refinery projects as well as reducing the ability of local and regional banks and financial institutions to fund such projects.

4.2 Issues and Options

This section considers the issues arising out of the SWOT analysis and presents possible options and actions that can be taken by the region.

4.2.1 Oil discovery and potential in the region

The discovery of oil and gas in the region does not only boost the economic prosperity of the region but also promises the region with the potential of being an oil producing and exporting area. The oil and gas discovered will add a new area of income and revenue source to the region in general and respective countries in particular. There are various options on how the oil discovered could be utilized depending on the amount of oil that is discovered i.e. whether small volumes of less than 50m bpd are discovered or whether volumes of more than 150m bpd are discovered.

Oil exploration and development progresses over many years. whereas the decision making should consider the reserve figures discovered at a certain point in time, it should not lose focus of the potential reserves not yet discovered as these have a fundamental bearing on the mode and method of utilization and exploitation and hence greatly impacting on the decision making process.

Dependant on the final volumes discovered, the following are some of the options;

i) Option I: Local use of crude

If the volumes so discovered are too low to justify establishment of a processing plant/refinery in the country, crude oil could be locally utilized by burning unprocessed crude to produce electricity. The utilization of crude oil in the electricity would be dependent on the future demand projections and requirements for the region based on the demand, hydrology and in comparison with other electricity sources in the country.
ii) **Option II: Local Refining**

If the volumes so discovered justify establishment of a local processing plant or refinery, then establishment of a local refinery to refine the crude oil would be the most feasible option. Local refining of crude would not only add value that would be otherwise lost if crude oil was exported, but would also offer other connected and associated benefits including, provision of employment, building of local capacity, facilitation of the industrialization process of the country, support and emergence of secondary industries such as the petro-chemical industry. Establishment of a local refinery would also lead to the production of other products such as LPG, fuel oil and bitumen which are otherwise expensive to import.

iii) **Option III: Exportation of crude and/or products**

If volumes so discovered are of quantities that justify exportation, crude oil could be exported via the coast. A combination of various transportation modes will be considered. But this is largely expected to include transportation by pipeline, road or rail to the Indian Ocean coast for refining or off-shore export.

The final choice will depend on the volumes of discovery, the economic justification and best form of utilization possible. Each of the attributes will need to be quantified and weighed against the alternatives. The economic, social and environmental safety assessments for each of the options will be critical in the options assessment.

4.2.2 **Mombasa Refinery Improvement**

The existence of the Mombasa refinery plays an important role in the petroleum products supply system for the east and central African region. In addition to providing the centre for key skills development, KPRL generates revenue and also supplies key petroleum products to the regional market.

It is in the overall interest of the region that the Mombasa refinery is upgraded to operate at full capacity. Upgrading of the KPRL will enable it meet the current challenges and improve on its efficiency. In the wake of the global trend in the movement of oil and energy requirements, rising prices, the existence of the KPRL acts as a balancing mechanism in the regional petroleum products supply system. When KPRL is upgraded to full capacity, i.e. 3.2 million tonnes, it will be able to supply over 90% of the Kenya’s current demand and will have a spill over effect to the supply economics of the region.
4.2.3 Infrastructure improvement

With or without crude oil, the final products have to be moved to the market. Infrastructure is very critical in the movement of oil.

Pipeline is the standard method for transporting oil and gas over land. Given that most of the East African region is landlocked, pipeline transportation will therefore be the most attractive method. Other options such as road, rail or water based methods should be evaluated dependent on the circumstances. Compared to other methods of bulk transportation, pipelines can be characterized as:

i) Well suited for handling large transport volumes

ii) Non-obtrusive: once installed, the pipelines lies underground and has less impact on the physical environment. The construction process does affect the environment significantly but temporarily and can be mitigated.

iii) Safe: pipelines once constructed are easy to secure from accidents and civil strife as compared to other modes of transportation.

iv) Durability: pipelines can last long if adequately protected against corrosion and erosion:

v) Economies of scale: large capacity pipelines generally have lower cost per capacity than smaller ones. Once installed, little extra cost is needed for the operation and maintenance.

vi) Large but limited capacity: once installed, there are limited possibilities of increasing the pipeline’s capacity. However some capacity increases can be achieved by installing more pumping capacity subject to the pressure the pipeline is designed to hold.

vii) Inflexible: pipelines are generally inflexible given that they transport oil between fixed points of origin and destination. Once constructed they are only able to move the product between the established points and cannot shuttle various points as is with other modes.

viii) Right of way: pipelines require isolated right of way. Although some activities can be undertaken over the area with a pipeline, this has to be done in a manner that does not expose the pipeline to risk of fire, physical security and exposure.

Therefore there is need to embrace the development of a regional pipeline network for the movement of oil and gas in the region. The type(s) of pipeline to be developed i.e. whether a products or crude pipeline will be dependant on the upstream developments, the reserves firmed up, the nature of crude and location of the proposed refinery among other factors.

Other infrastructure important for oil distribution and transportation include the rail system, the road distribution system and the ports facilities. For the movement of the refined products both for the present imports and future locally refined products the present infrastructure will need to be
improved in order to efficiently deliver and distribute petroleum products within the region.

Improved infrastructure will increase the reliability of petroleum supply to the different parts of the region. Cooperation frameworks between the Partner States should be established. This will enable coordinated, efficient and economic development of regional infrastructure.

4.2.4 Strategic Storage Infrastructure

Most of the East African region is land locked. Any disruption in the supply system will have significant effect on the economies in the hinterland. Security of supplies therefore is critical for these economies. Even if local oil production is achieved, occasional shut downs cannot be avoided and routine maintenance periods are industry standard practices. It is therefore important to ensure that the regional storage capacity is sufficient to buffer the region in case of a disruption in the supply or occasional shut down. The size and location of the storage of each Partner State should be determined by the respective market size and consumption pattern. The structure of the strategic storage should be determined by frequency and reliability of supply, consumption rates, nature, level and type of operations in accordance with the respective national laws.

Considering the respective countries demands against their respective storage capacities and ability to provide buffer in the case any disruption in supply, it is found that Kenya has the highest cover of about 140 days followed by Burundi and Tanzania with about 115 and 106 days of consumption, respectively. Uganda has the least buffer of about 25 days followed by Rwanda at about 50 days. Uganda will therefore need to expand its strategic storage capacity to appropriate levels to buffer the country.
5 REGIONAL REFINERY DEVELOPMENT FRAMEWORK

5.1 Vision

As exploration efforts for hydrocarbons in the Region have begun to yield encouraging results in form of commercial discoveries, it is necessary to address development issues pertaining to the exploitation of the resource in a way that ensures sustainable social and economic development in the region. Therefore, the vision for the Strategy on Development of Regional Refineries is:

To achieve maximum value addition to the regional fossil fuels for improved quality of life for the people of East Africa.

5.2 Stakeholders

Key stakeholders in the oil and gas industry include the Governments of the EAC Partner States, The people of East Africa, Investors, Development Partners and Countries neighbouring EAC region. Investors include
- Oil and gas exploration companies
- Oil marketing companies
- Individual investors
- Governments
- Pension funds
- Financial institutions
- Private institutions
- Oil Pipeline and transporting companies

5.3 Objectives

The overall objective of the Strategy is to ensure harmonised development of refineries in the East African Community to enable value addition to petroleum discoveries in the region and ensure better security of supply for the region. Specific objectives are to:
- boost the region’s refining capacity;
- contribute to the region’s growing energy needs;
- attain security of supply of fossil fuels in the region;
- achieve least cost supply of products;
- earn revenues to support development in the region including poverty reduction, education, health and other human development;
- create investment opportunities in the region;
- contribute to sustainable development;
- create employment and assist in wealth distribution;
• enable transfer of knowledge and ensure availability of technically qualified human resource in the region; and
• facilitate industrialisation.

5.4 Refinery Development

5.4.1 Reserves
The indication from the discoveries in the Albertine Graben of Uganda is that expected oil reserves are in the range of 500 million barrels. This implies that production of 150,000 barrels of oil per day could be achieved in the next five years. Currently, appraisal programs are being undertaken to firm up these reserves. It is important to note that these expected reserves are only in about 10% of the Albertine Graben where exploratory drilling has taken place.

Exploration activity is also being undertaken in the other Partner States. Although commercially viable discoveries of oil have not been made yet, the chances of finding oil in the basins of Tanzania and Kenya are also high and this will impact on the development of future refineries other than what is recommended in this strategy.

Tanzania has natural gas reserves and been production of the gas has been going on since 2004. Proven reserves are estimated at 920bcf. Most of the gas is used for electricity generation although use for other industrial activities is being explored.

5.4.2 Demand
The demand for petroleum products for the wider East African region currently amounts to 7.9 million tonnes per annum which is 162,000 bpd crude oil equivalent. If the demand grows in tandem with economic (GDP) growth it will reach 209,000 bpd in 2010, 290,000 bpd and 400,000 bpd and 555000 bpd in 2015, 2025 and 2030 respectively. A sensitivity case for a lower growth rate shows that demand for petroleum products will be 184,000 bpd in 2010, 217,000 bpd in 2015 and 257,000 bpd and 302,000 bpd in 2025 and 2030 respectively. Given this demand, a new refinery in the region is feasible.

5.4.3 Existing Refinery
KPRL is the only refinery in East Africa. It is 50% owned by the Government of Kenya and the remaining shareholding by three oil companies namely Shell, BP and Chevron. KPRL currently processes 1.6 million tonnes a year (35,000 bpd crude oil equivalent) although it has a potential capacity of 3.2 million tonnes (70,000 b/d crude oil equivalent).

The under utilization of the existing refinery is due to efficiency limitations from the available hardware. There are, however, plans to
install a residue thermal cracking unit and diesel desulphurization facility to improve efficiency of the refinery at a cost of US$400 million. The resulting efficiency improvements as well the ability to produce environmentally friendly products will enable the utilization to be raised from 1.6 million tones to 3.2 million tones per year and increase the production of LPG from the current 30,000 tones to 110,000 tones. KPRL currently receives parcels of 80,000 tonnes of crude oil due to limitations of the harbour. Plans are underway to dredge the harbour to allow for ships with up to 150,000 tonnes capacity which will result in a reduction in freight charges.

5.4.4 The case for a new refinery
When the oil reserves in Uganda are firmed up, a new regional refinery will need to be built if found feasible. The key drivers for development of a new refinery include the following, among others:

i) Value Addition
Refining the crude produced in the region adds value to the crude compared to exporting crude. In addition to the primary products of refining, there are a number of industries that use feedstock from refinery products. These include; petrochemical industries, bitumen and asphalt manufacturing, pharmaceuticals etc.

ii) Satisfying the available market
The demand for petroleum products in the wider East African region which is estimated at 162,000 bpd cannot be satisfied by KPRL even after the planned modernization. Table 10 below shows the total crude oil demand, the capacity of the existing refinery and the gap that would be filled by the new refinery in the region if demand grows in tandem with economic growth rate. The gap ranges from 82,000 bpd in 2008 to 475,000 bpd in 2030.

Table 10: Gap to be filled by new refinery if petroleum demand grows in tandem with the GDP growth rate

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2010</th>
<th>2015</th>
<th>2025</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Regional Demand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacity of KPRL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gap potentially to be filled by new refinery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2010</th>
<th>2015</th>
<th>2025</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Regional Demand</td>
<td>162,000</td>
<td>209,000</td>
<td>290,000</td>
<td>400,000</td>
<td>555,000</td>
</tr>
<tr>
<td>Capacity of KPRL</td>
<td>80,000</td>
<td>80,000</td>
<td>80,000</td>
<td>80,000</td>
<td>80,000</td>
</tr>
<tr>
<td>Gap potentially to be filled by new refinery</td>
<td>82,000</td>
<td>129,000</td>
<td>210,000</td>
<td>320,000</td>
<td>475,000</td>
</tr>
</tbody>
</table>
Table 11 below shows the total crude oil demand, the capacity of the existing refinery and the gap that would be filled by the new refinery in the region if demand grows at half the projected economic growth rate. The gap ranges from 82,000 bpd now to 222,000 bpd in 2030.

**Table 11:** Gap to be filled by new refinery if petroleum demand grows at half the GDP growth rate

<table>
<thead>
<tr>
<th></th>
<th>Barrels per day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2008</td>
</tr>
<tr>
<td>Total regional Demand</td>
<td>162,000</td>
</tr>
<tr>
<td>Capacity of KPRL</td>
<td>80,000</td>
</tr>
<tr>
<td>Gap potentially to be filled by new refinery</td>
<td>82,000</td>
</tr>
</tbody>
</table>

iii) **Employment Creation, Wealth Distribution and Transfer of Knowledge**

Once a refinery is set up together with the attendant manufacturing industries, there will be opportunities for employment created and a general improvement of the standards of living of the people. This also enables the development of a local human resource capacity.

iv) **Location of the Refinery**

The crude oil discovered that has so far been discovered in Uganda has a high pour point and solidifies at a temperature lower than 40°C. Transportation of the crude oil over a long distance in a pipeline would necessitate heating the pipeline. For very long distances, this can be a very expensive undertaking. Therefore the refinery would need to be located not far from the oil fields.

v) **Security of supply**

When the local crude is refined in the region, the products will be easily available to the countries in the region. This will improve access and security of supply of these products by reducing the supply lead time among other benefits.

vi) **Offsetting the large import bill of crude oil and refined products**

The regional demand of 162,000 bpd implies an annual foreign expenditure of over US$5.3 billion at the current crude oil price of US$90 per barrel. This is a huge expenditure compared to exports earnings of the region. Although the petroleum reserves may be
owned by one Partner State, their exploitation and refining in the region will offset the cost of purchase and transportation from overseas.

5.5 Supporting Infrastructure

5.5.1 RAILWAYS

Southern Corridor

The railway system through Tanzania consists of two main lines and three branch lines with a total of approximately 2,700 km of a single track meter gauge. The main lines are

(a) Central line which runs from Dar es salaam to Tabora (838 km) branching to Mwanza (374 km) and to Kigoma (412 km).
(b) Tanga line which runs from Tanga to Moshi and Arusha (438 km).

The two lines are connected by the Ruvu – Mruazi link line (188 km)

The Tanzania Railways is connected to Uganda and Kenya Railways by wagon ferries over Lake Victoria at Port Bell in Kampala and at Kisumu in Kenya. In addition the system is linked to Kenya Railways by the Kahe – Voi line on the Tanga line

The Railway system in Tanzania is currently constrained by insufficient locomotives, tank wagons, oil tankers, telecommunication and signaling system.

Arrangements are underway for Tanzania Railways Limited (TRL) to hire fifteen (15) locomotives to be delivered as follows:-

- 5 in March, 2008.
- 5 in June, 2008.
- 5 in August, 2008.

TRL took over the running of the Railway system from Tanzania Railways Corporation (TRC) on 1st October, 2007 under a concession agreement for a period of 25 years.

The Rail Assets Holding Company (RAHCO) is responsible for the development of rail infrastructure in Tanzania. RAHCO has planned to improve the railways as follows:-

1. Construction of Isaka-Kigali railway line

   Status: Feasibility study expected to be completed by end of July, 2008. Study performed by DB International.
2. Upgrading Dar es Salaam-Kigoma railway line 80 lb/yd.

Status: Current axle load: 13 tons. The intention is to change the central line to 120 lb/yd

3. Construction of concrete sleepers production plant at Tura Quarry

Status: Expression of Interest for consultancy under evaluation


Status: Expression of Interest for consultancy under evaluation

5. Construction of Dry Port at Katosho, Kigoma to serve Burundi and Rwanda

Status: Expression of Interest for consultancy under evaluation

Northern Corridor

Kenya’s railway infrastructure spans from the port of Mombasa to the central highlands regions, Lake Victoria to Kampala and proceeding to kasese which is the town near the boarder with Democratic Republic of Congo. The railway system is currently being managed by Rift Valley Railways Consortium having been concessioned in 2006. The mainline from the port of Mombasa to Malaba is 1,082 km of main track.

The rail transport system offers both domestic services and trans-national rail links with Uganda and Tanzania for import, export and transit cargo to Great Lakes region and Southern Sudan. It is used to handle both bulk cargo and passengers and provides both inland and marine services. There are plans to expand its market and capture the transport need of the new generation of heavier containers through the purchase of 300 heavy-duty container wagons. It is also proposed that in future a line be constructed from Kampala to the Southern Sudan to open up more efficient trade lines with the new Southern Sudan market.

Due to the present condition of the track network, temporary speed restrictions are imposed leading to slowing the delivery of goods to various destinations within the region. Rift Valley Railways (RVR), now managing Kenya and Uganda rail systems, has promised to improve the situation drastically within the next five years, during which it will prioritise track renewal, locomotive availability and wagon overhaul. The concessionaire aims to raise overall freight volumes carried by 75%, and expects to handle some 80% of the goods moving in and out of the harbour compared with about 15% in the recent past. The operational takeover will run for 25 years from the year 2006.
5.5.2 PORTS

Kenya

Mombasa is the principal seaport providing connection to landlocked neighbouring countries. It is a multipurpose deep sea ship going port with multimodal links. The port of Mombasa has a capacity to handle 22 million tonnes of cargo annually, of which only 60-65% is being utilized. This is occasioned by the poor off-take by rail and lack of adequate capacity by road and poor infrastructure hence raising its occupancy level. The port handled 3.5 million tonnes of transit cargo in 2005. Cargo destined for Uganda comprised 75.8%, Tanzania 8%, Rwanda 6.2% and Sudan 4.2%.

This deepwater port which has 21 berths, 2 bulk oil jetties and dry bulk wharves, handles all types of cargo. The port of Mombasa is linked to the world’s major ports with over 200 sailing per week to Europe, North and South America, Asia the Middle East, Australia and the rest of Africa. Currently, it is undergoing comprehensive restructuring aimed at enhancing efficiency and delivery of services. KPA has already acquired modern equipment for Mombasa port to improve its capacity to handle traffic. In the short term an additional berth will be built to boost operational capacity and it is expected to be completed in 2009. In the long term the Kenya Ports Authority is focused on developing another commercial port at the Coast. Kisumu port is an inland container depot which has a railtainer. The port has a capacity design to handle 15,000 MT annually.
Tanzania
The status of various infrastructure in Tanzania is summarized in the tables below:

<table>
<thead>
<tr>
<th>No.</th>
<th>Infrastructure</th>
<th>Capacity</th>
<th>Current Status</th>
<th>Limitations</th>
<th>Work in Progress</th>
<th>Upgrade News</th>
<th>Ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>KOJ – 1 Dar es Salaam</td>
<td>12m draft ships (40,000 DWT)</td>
<td>Operational</td>
<td>None</td>
<td>2 New 8’’ vegetable pipelines</td>
<td>Emergency Shut Down System (ESD) June, 2008</td>
<td>TPA</td>
</tr>
<tr>
<td>2</td>
<td>KOJ – 2 Dar es Salaam</td>
<td>7m drafts ships (5,000 DWT)</td>
<td>Operational</td>
<td>None</td>
<td>1 New LAG Pipeline</td>
<td>Emergency Shut Down System (ESD) June, 2008</td>
<td>TPA</td>
</tr>
<tr>
<td>3</td>
<td>SBM Dar es Salaam</td>
<td>100,000 DWT</td>
<td>Operational</td>
<td>None</td>
<td>Feasibility Study</td>
<td>Modernize to 120,000 DWT multi-product facility</td>
<td>TPA</td>
</tr>
<tr>
<td>4</td>
<td>Three CMB - Tanga</td>
<td>5,000 DWT Ships</td>
<td>Operational</td>
<td>Not operational in rough seas</td>
<td>None</td>
<td>Not Known</td>
<td>Private</td>
</tr>
<tr>
<td>5</td>
<td>Quay Wall - Mtwara</td>
<td>9m draft ships</td>
<td>Operational</td>
<td>None</td>
<td>Flow Meters August, 2008</td>
<td>None</td>
<td>TPA</td>
</tr>
<tr>
<td>6</td>
<td>Quay Wall - Mwanza South</td>
<td>6m draft ships</td>
<td>Operational</td>
<td>None</td>
<td>Flow Meters August, 2008</td>
<td>Fix Fenders 2008</td>
<td>TPA</td>
</tr>
<tr>
<td>7</td>
<td>Kibirizi Oil Jetty - Lake Tanganyika</td>
<td>6m draft ships</td>
<td>Operational</td>
<td>None</td>
<td>Dredging, 2008</td>
<td>None</td>
<td>TPA</td>
</tr>
<tr>
<td>8</td>
<td>Bukoba Port</td>
<td>6m draft ships</td>
<td>Operational</td>
<td>None</td>
<td>Port Access Road 2008</td>
<td>None</td>
<td>TPA</td>
</tr>
<tr>
<td>9</td>
<td>Musoma</td>
<td></td>
<td>Operational</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>TPA</td>
</tr>
</tbody>
</table>

The status of vessels operating in the Tanzanian inland ports is provided below:

<table>
<thead>
<tr>
<th>NAME</th>
<th>LOCATION</th>
<th>CURRENT STATION</th>
<th>CAPACITY (LITRES)</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAKE VICTORIA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MT Nyangumi</td>
<td>Mwanza</td>
<td>In order</td>
<td>410,000</td>
<td></td>
</tr>
<tr>
<td>MV. Thor</td>
<td>Mwanza</td>
<td>- do -</td>
<td>250,000</td>
<td></td>
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<tr>
<td>MV. Umoja</td>
<td>Mwanza</td>
<td>- do -</td>
<td>880,000</td>
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<tr>
<td>MV. Mnanka</td>
<td>Mwanza</td>
<td>- do -</td>
<td>200,000</td>
<td></td>
</tr>
<tr>
<td>LAKE TANGANYIKA</td>
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<td></td>
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<tr>
<td>Mt. Sangara</td>
<td>Kigoma</td>
<td>In order</td>
<td>73,000</td>
<td></td>
</tr>
</tbody>
</table>
5.5.3 ROAD NETWORK

The road network which is currently being used for transporting petroleum products in the Region includes the following:-

1. Mombasa–Malaba–Kampala–Katuna Corridor

2. Dar es Salaam–Dodoma–Isaka–Mutukula–Isaka Corridor (1739 km)
   (i) Dar es Salaam–Dodoma–Saranda section (536 km) is paved and is in good condition
   (ii) Saranda–Manyoni–Isuna section (87 km) is unpaved and the riding quality is fair. Upgrading works ongoing and are expected to be completed in the next three years
   (iii) Isuna–Singida–Tinde section is paved and is in good condition
   (iv) Tinde–Isaka–Biharamulo section
   (v) Biharamulo–Muhutwe section
   (vi) Muhutwe–Bukoba section (138 km) is paved and is in good condition
   (vii) Mutukula–Masaka section

   (i) Biharamulo–Bwanga section is unpaved, upgrading works are ongoing and are expected to be completed in three years.
   (ii) Bwanga–Geita section (41.5 km) is paved and is in good condition
   (iii) Geita–Usagara section (97 km) is unpaved, upgrading works to bitumen are scheduled to commence in 2007/2008 financial year and are expected to be completed in four years.
   (iv) Usagara–Mwanza section is paved and in good condition.
   (v) Mwanza–Musoma–Sirali section (328 km) is paved and is in good condition.

4. Nyakanazi–Kasulu–Sumbawanga–Tunduma Corridor

5. Dar es Salaam–Iringa–Mbeya–Kyela–(to border with Malawi)

6. Mbeya–Tunduma (to border with Zambia)

7. Dar es Salaam–Moshi–Taveta (612 km)–Voi
   (i) Dar es Salaam–Moshi–Taveta section (612 km) is paved and in good condition.
   (ii) Taveta–Voi section is unpaved

8. Manyoni–Tabora–Kigoma–Manyovu–(to border with Burundi)
(i) Manyoni-Itigi-Tabora-Kidahwe section (63 km) is unpaved and funds for upgrading are being sourced.

(ii) Kidahwe-Kigoma section (30 km) is unpaved, upgrading works to commence during 2007/2008 financial year. To be completed in the next three years.

(iii) Kigoma-Manyovu section is unpaved.


5.5.4 PIPELINE SYSTEM

Kenya

The Oil Pipeline began operations in February 1978. The Nairobi-Mombasa pipeline segment (Line 1) has pumps at Mombasa and at three intermediate booster stations. The Mombasa-Nairobi pipeline is 14 inches in diameter and is about 450 km long. The currently installed pumping capacity is 440m$^3$ (440,000 litres) per hour though the capacity enhancement programme is underway to double the flow rate.

The Western Kenya Pipeline Extension (Line 2) is 8 inches in diameter up to Burnt Forest where it reduces to a 6 inch diameter pipe. From Sinendet Line 3 tee’s off to Kisumu and is 6 inches in diameter. It was commissioned in early 1994. The Western Kenya depots in Nakuru, Kisumu and Eldoret are equipped with loading arms for loading road tankers and rail wagons. The pumping capacity of lines 2 and 3 is 220m$^3$ (220,000 litres) per hour.

Tanzania

There is one pipeline from Dar es Salaam to Ndola in Zambia which is used to transport crude oil to the Indeni Refinery in Zambia. Currently spiked crude oil for Zambia is discharged through the SBM to the Tanzania and Zambia (TAZAMA) storage facility in Kigamboni area.

There is 16"diameter pipeline that transports gas from Songo Songo Island to Dar es Salaam, a distance of 230km.
5.6 Recommendations

Based on the considerations discussed above, it is recommended as follows:

1. Refineries development.
   i) In order for the oil discovered in Uganda to provide optimal benefits to the region, it is recommended that a refinery be developed near the oil fields in Uganda contingent on the relevant studies and assessments.
   ii) The planned upgrading of the Mombasa refinery should be accelerated;

2. Storage Facilities
   i) Additional storage facilities should be installed in Uganda to ensure strategic coverage at least 30 days of operation.

3. Pipelines
   i) The Eldoret-Kampala pipeline project should proceed as a priority;
   ii) The planned capacity enhancement of Mombasa-Nairobi pipeline should be fast tracked;
   iii) Implementation of a parallel pipeline from Nairobi to Eldoret should be fast tracked;
   iv) Feasibility study for the Kampala-Kigali-Bujumbura should be expedited;
   v) Development of the proposed Dar es Salaam-Tanga-Mombasa natural gas pipeline should be expedited;
   vi) The proposed Dar es Salaam-Mwanza oil pipeline should be studied with a view to effecting implementation.

4. Port Facilities
   i) Replacement of Single Bouy Mooring (SBM) at Dar es Salaam port into a multiple product off loading facilities should be undertaken as a priority;
   ii) Development of the proposed second oil jetty in Mombasa should be prioritized to boost the handling capacity at the Mombasa port;
   iii) Refurbishment and improvement of handling and receiving facilities including ferries and barges at the inland ports of Port Bell, Jinja, Mwanza, Kigoma and Bujumbura should be prioritised;
   iv) Construction and development of a jetty at Kisumu port should be prioritized.

5. Railways
   i) Improvement in efficiency and infrastructure on the southern corridor line between Dar es Salaam and Mwanza and Kigoma; and
ii) Improvement in efficiency and infrastructure on the northern corridor line between Mombasa and Kasese

6. Roads
   i) Improvement of bad sections on the southern corridor road system Dar es Salaam-Isaka-Bujumbura/Kigali/Mutukula; and
   ii) Improvement of bad sections on the northern corridor line Mombasa – Busia/Malaba-Kampala-Kigali-Bujumbura.

7. Possible Future Projects
   iii) Southern Sudan pipeline
       With regard to crude from Southern Sudan, there are potential financial, social and environmental benefits for the development of a pipeline from Southern Sudan to the East Coast.

   iv) Kampala-Juba Railway Line.
       With peace having returned to Southern Sudan, this region has witnessed tremendous growth in economic activity. Currently, there is significant movement of goods including petroleum products from Uganda into Southern Sudan. A railway line from Kampala would further promote this trade.

It should be noted that technical and commercial viability assessment for all the above projects will be necessary before implementation.
6 IMPLEMENTATION FRAMEWORK

6.1 Introduction
This chapter describes how the strategy is to be implemented. It discusses organizational and ownership structure for any future development of refinery(ies) and associated infrastructure, the resources and capacity requirements focusing on the financing options and human resources requirements. The chapter concludes by giving an indicative timeframe for implementations of the key components of the strategy.

6.2 Organizational, Ownership Structure and Legal Framework
There are a number of possible options for the ownership of the proposed refinery(ies) as well as proposed associated infrastructure such as pipelines as well as for their construction, operation and maintenance.

i) Option I: a single company builds and operates the refinery and also builds and operates the associated distribution system (pipeline infrastructure).

ii) Option II: a single company builds and operates the refinery and another single company builds and operates associated distribution system.

iii) Option III: a single company builds and operates a refinery and the distribution system is left to the market to create.

If the supportive infrastructure such as a pipeline is to move from one country to another, it will become an interstate pipeline. Interstate pipelines are subject to both local and international/regional legislation. Even in option I where a single company builds and operates the refinery and associated distribution infrastructure, it will very much depend on the structure that the Governments of the EAC Partner States choose for refinery development.

It is be possible for the construction of the refinery to be undertaken by a single country and also for the distribution infrastructure within each particular country to be taken as distinct and as such subject to a different jurisdiction and therefore being treated as single projects. However, this could prove to be a costly and less efficient way of building a regional refinery and regional distribution system subject to the same quality and performance requirements as one that has been built as a single project for the region.

In all of the options considered above, there are a number of steps required of the Governments of Burundi, Kenya, Rwanda, Tanzania and Uganda for the regional refinery development to proceed:
i) The Governments need to negotiate and sign a Memorandum of Undertaking-MOU (an Umbrella Agreement) within which they agree to facilitate the development of regional refinery(ies) and indicate the possibility of participation by Burundian, Kenyan, Rwandese, Tanzanian and Ugandan interests. The MOU should among others establish a coordinating mechanism such as Joint Coordinating Commission for the development of regional refinery(ies) and other associated distribution systems.

ii) The Governments need to negotiate and sign an intergovernmental Agreement (IGA). The IGA shall define specific legal, commercial and financial arrangements, schedules for acquiring all documentation and permits required for the financing of project(s), construction of the refinery and if necessary details of equity participation in the project. Partner States may also sign these functions to a joint refinery company.

iii) The host Government will need to sign a Host Agreement with the refinery company.

6.2.1 Options Assessment Criteria
Each of the ownership options will have to be examined in detail in comparing them against a number of assessment criteria. The following criteria shall be used as a minimum in order to identify a preferred option and to generate a ranking of the three options.

i) The manner in which the option would be structured.

ii) Legal considerations, the number and type of agreements that are required for the option to work.

iii) Financing issues, in particular whether project financing is required and the implications for the project of that requirement.

iv) Economic efficiency: whether the economics justify and support the option.

v) Technical considerations, whether another refinery is needed in another country, chemical characteristics of the crude oil discovered, logistics, market etc.

vi) The options attractiveness to potential private sector investment.

vii) Whether the interest of the consumers, local population and the country of discovery are satisfied.

viii) The options advantages and disadvantages.
6.2.2 Issues Common to All Options
There are a number of requirements contained in the respective national laws of the five countries which will have to be taken into account for the proposed refinery(ies) to be developed. Depending on the final development and ownership structure that will be agreed upon, the respective national laws will be reviewed with respect to; International tender procedures, the taxation regime, tax treaties, requirements to establish a local company, trade and taxation treaties, taxation policy on fuel products, local legislation etc to assess how these impact on the regional refinery development.

6.2.3 Legislative Changes
The respective national legislations will be assessed in order to ensure that the activities related to regional refinery development are well provided for in the respective laws.

6.3 Resource and Capacity Requirements
A key requirement needed for the development of a refinery(ies) and associated infrastructure is resources in terms of finances and human resource. The resources are raised by the shareholders of the development. Partner States will first need to agree on the mode of implementation. Broadly there are three possible modes;

- Individual country
  This is where the individual country where the oil discoveries have been made develops the refinery and associated in-country infrastructure singularly. Implementing this option could be strenuous as it will mean that the country if will raise the required resources individually.

- Joint Partner States Development Structure
  This is where two or more Partner States decide to jointly develop the refinery and or the associated infrastructure. To this end, the participating countries will be responsible for raising the requisite resources to develop the agreed project(s).

- Public Private Partnership
  The core concept involves the private sector working together with the public sector and/or development partners to undertake an investment. The private sector is invited to invest in public service or public-private infrastructure for example through concession agreements. The biggest advantage of the PPPs is that financial resource commitments are shared and financial risks tend to be transferred to those who can best manage them. There is a growing momentum for the PPPs as one of the ways of mobilizing resources and undertaking projects especially of big magnitudes.
- Private sector
  The other option that exists is for the private sector to undertake the development of the refineries and the associated infrastructure. Here the respective country(ies) will not be required to raise any resources for investment but rather to only facilitate private sector investments. However this option will only be attractive if the Partner States are satisfied that their objectives and long term interests are well met under the private sector investments.

6.4 Financing Options
Depending on the method of implementation of the refinery development, in each of the method the requisite finances will have to be raised. There are various conventional financing options available for consideration. These include venture capital, asset based financing, long term debt financing, lines of credit, etc. This financing could be in various modes such as structured finance, project finance, non-recourse lending.

Different lenders have various types of term loans and the project promoters will have to identify the most appropriate lenders for the project. Development institutions such as the World Bank, African Development Bank, European Investment Bank, Export Credit Agencies, bonds etc and bilateral arrangements tend to have more attractive lending terms than conventional commercial banks.

Further, different sources of finances may be appropriate for different stages of development. Initial finances for mobilization and promotion will often rely on shareholders who will either be the respective country or jointly the participating Partner States or the private sector. As the developments and projects are firmed up, then there will be a need to turn to alternative sources. Below are some of the various options that could be considered for possible financing of refinery development.

6.4.1 Equity Financing
Equity funds are finances from the project owners or shareholders; this could be from the public finances. The equity funds are normally unsecured and have no registered claim on any of the assets of the projects, freeing up those to be used for collateral for the loans (debt financing).

6.4.2 Leveraged Financing
This is a combination of equity financing and debt financing. Some portion is financed by the equity from shareholders and the balance by debt. Leverage financing is increasingly a common form of financing for big projects. Project promoters have to determine the level of equity they wish to inject into the project. The promoters of the project will have to decide on the appropriate gearing ratio for any proposed refinery(ies) and associated infrastructure development.
6.5 Human Resource Development

A skilled and professional human resource is critical for refinery development. A well planned and deliberate human resource development effort is needed to develop the critical human resource needed to support the refinery development in the region.

Like all other regions around the world, the EAC Partner States are not likely to have sufficient human resources to manage the construction and operations of the new refineries, petrochemical plants and the supporting infra structure. The situation is likely to be worse than other regions since the oil and gas industry in the region is relatively small and also because the Partner States score poorly on the Human Development Index. The table below shows selected human development indicators for the Partner States. Both the human development index and illiteracy level indicate the need for intervention.

**Table 12: Selected Human Development Indicators (2007/08)**

<table>
<thead>
<tr>
<th></th>
<th>Burundi</th>
<th>Kenya</th>
<th>Rwanda</th>
<th>Tanzania</th>
<th>Uganda</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human development Index</td>
<td>0.413</td>
<td>0.521</td>
<td>0.452</td>
<td>0.467</td>
<td>0.505</td>
</tr>
<tr>
<td>Human development Rank out of 177</td>
<td>167</td>
<td>148</td>
<td>161</td>
<td>159</td>
<td>154</td>
</tr>
<tr>
<td>Literacy rate (% of adults above 15)</td>
<td>59.3</td>
<td>73.6</td>
<td>64.9</td>
<td>69.4</td>
<td>66.8</td>
</tr>
<tr>
<td>Gender adjusted development index (GDI)</td>
<td>0.409</td>
<td>0.521</td>
<td>0.450</td>
<td>0.464</td>
<td>0.501</td>
</tr>
</tbody>
</table>


The key skills that are required to support a vibrant oil and gas industry include engineering professionals (petroleum, chemical, electrical mechanical and process), economists, lawyers and financial analysts. Other than graduates in the foregoing professions, technicians from polytechnics and artisans from trade and vocational institutions will also be required. Non-skilled labour will be required for infrastructure development.

To support the development of a strong oil and gas industry in the region, it is necessary to develop human resources in order to create a pool of skilled workforce and raise the level of productivity. Partner States will have to ensure that they are able to promote, attract, train and retain key professionals. The following steps will be necessary to achieve this objective;

- The partner states should undertake extensive training of its professionals in the key refinery aspects.
- Harmonise policies for employment creation and productivity improvement with a view to enhance labour absorptive capacity, and reduce brain drain in the region.
- The EAC will support a coordinated human resource development in the fields of refinery development among the partner states.
- Develop and put in place strategies to address gender disparities in human resource development.
- Expand existing or establish centers of specialization and excellence for the training on technical disciplines that are supportive to the petroleum industry from vocational training through to University levels.
- The partner states will ensure that training and development of the human resource capacity is undertaken in tandem with the regional refinery(ies) developments.

6.6 Time Frame
This Strategy has been structured for the period 2008-2013. Various options for organizational and ownership structure for future development of refinery(ies) and associated infrastructure, the resources and capacity requirements focusing on the financing options and human resources requirements have been explored. In order for the Strategy to succeed and achieve its objectives, the following will need to be undertaken as a matter of priority;

i) Coordinating Committee
Following adoption of the Strategy by the Partner States, a Coordinating Committee should be established to spearhead implementation of the Strategy.

ii) Memorandum of Understanding
Following adoption of the Strategy by the Partner States, an MOU should be signed within 12 months.

iii) Human Resource Development
The upstream activities in the region are progressing at a steady rate. The refinery developments are already underway. It is therefore important that the training and development of the critical mass to support the refinery development of the region is accelerated.
7 REFERENCES


APPENDICES

Appendix I: Terms of Reference
Appendix II: Task Force Members
TERMS OF REFERENCE
REGIONAL PETROLEUM REFINERY DEVELOPMENT STRATEGY

1. INTRODUCTION

All fossil fuel imports into the East African Community pass through the Kipevu and Shimanzki Oil Jetties in Mombasa and the Kurasini Oil Jetty and Single Buoy Mooring (SPM) at Kigamboni in Dar-es-Salaam.

The imported crude is processed at Mombasa, where the only refinery in the region, with an installed capacity of 3.2 million tonnes per annum, is located. However, it is currently operating below capacity due to inadequate investment in new processing technology and is processing only 1.6 million tonnes per annum. This processing level does not meet current demand in the region which presently stands at 5.7 million tonnes. The shortfall is covered by importation of refined products.

Strategic storage of petroleum products in some parts of the region is inadequate. Existing logistical facilities in the region are inadequate to sustain the existing and projected demand.

The magnitude of exploration activities in the region and the discoveries of hydrocarbon resources in the Albertine Graben in Uganda provide an opportunity for strengthening the region’s fossil fuel supplies. For those resources to provide optimal benefits to the region, their utilisation will have to be considered in the context of the region’s evolving energy needs, other available energy resources, infrastructure requirements, alternative export opportunities and environmental issues.

At its Extra-Ordinary Meeting in Kampala on 18th June 2007, the Summit of the Heads of State, in recognition of the importance of boosting the refinery capacity in the region and in view of the discoveries in Uganda, directed the EAC Secretariat to develop a strategy on harmonised petroleum refinery in the region and provide a progress report in November 2007.

2. OBJECTIVES

The overall objective of the assignment is to prepare a strategy for harmonised development of refinery services in the region. The strategy should address issues pertaining to establishment, location, ownership structure, operational logistics and capacity. Specific objectives include:

i. Examine the existing policy, legal regulatory and institutional framework on refinery development in the region.

ii. Examine the current contractual and operational status of the existing refinery.

iii. Examine the issues which need to be addressed at national and regional levels for the purpose of promoting optimal refinery developments in the region.
Appendix I

iv. Examine existing contractual obligations under the current Production Sharing Agreements/Contracts (PSA’s/PSC’s) in the Partner States in regard to refineries/pipeline development.

3. SCOPE OF WORK

The study will encompass the Partner States of Kenya, Uganda, Tanzania, Rwanda and Burundi. The study will also describe and consider interactions with countries in the wider region which have significant energy trade links with the EAC. These include; Southern Sudan, eastern Democratic Republic of Congo, Malawi and Zambia.

The tasks will include but not limited to the following:

i. The existing policy, legal, regulatory and institutional framework on refinery development in the region;

ii. The current and projected situation with regard to crude oil supply, refinery capacities, storage and transportation infrastructure;

iii. Strengths, constraints and weaknesses of the current systems with regard to the region’s needs;

iv. Implication of the recent discoveries on refinery development in the region;

v. The issues that need to be addressed at national and regional level for the purpose of promoting optimal refinery development in the region.

vi. Develop a strategy for a regional approach in the development of refineries in the region;

vii. Resource and capacity requirements;

viii. Recommendations for next steps at regional and national levels; and

ix. Prepare a report for submission to the Summit of the Heads of State.

4. TASK FORCE

The task force shall comprise of the following. However, the task force may co-opt persons with required expertise in order to effectively carry out the assignment:

i) Two representatives per Partner State; one from the Ministry responsible for energy and the other from the national oil institution;

ii) One representative from KPRL; and

iii) One representative from the EAC Secretariat.
Appendix I

5. TIME FRAME

It is proposed to undertake the assignment between November 2007 and the 9th Summit of EAC Heads of State scheduled for 10th March 2008. The proposed schedule of activities is shown in Table 1 below.

Considering that team members are involved in other activities in their institutions, it is proposed that the team meets for once a month in November, December and January 2008. Each meeting will have a working session and will incorporate site visits. The meetings will, therefore, be held in Dar es Salaam, Mombasa and in Entebbe.

Table 1: Schedule of Activities

<table>
<thead>
<tr>
<th></th>
<th>Activity</th>
<th>Duration</th>
<th>Start</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kick-off meeting + site Visits in Dar es Salaam</td>
<td>4 days</td>
<td>19-Nov-07</td>
<td>22-Nov-07</td>
</tr>
<tr>
<td>2</td>
<td>Working session + Site Visits in Uganda</td>
<td>5 days</td>
<td>14-Jan-07</td>
<td>18-Jan-07</td>
</tr>
<tr>
<td>3</td>
<td>Working session + Site Visits to Mombasa</td>
<td>4 days</td>
<td>4-Feb-08</td>
<td>7-Feb-08</td>
</tr>
<tr>
<td>4</td>
<td>Chairman and Rapporteur present to Sectoral Council</td>
<td>5 days</td>
<td>25-Feb-08</td>
<td>29-Feb-08</td>
</tr>
<tr>
<td>5</td>
<td>15th Ordinary Meeting of Council of Ministers</td>
<td>5 days</td>
<td>03-Mar-08</td>
<td>07-Mar-08</td>
</tr>
<tr>
<td>6</td>
<td>9th EAC Summit</td>
<td>1 day</td>
<td>10-Mar-08</td>
<td>10-Mar-08</td>
</tr>
</tbody>
</table>
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