

# **Discussion paper on bitumen supply capacity in South Africa**

March 2007

## **1. Back ground**

The President's office of South Africa has commissioned an urgent study into the supply of construction materials required to support planned infrastructure development foreseen under the government's economic ASGISA initiative. The proposed increase in public sector investment will substantially increase the demand for construction materials such as bitumen for the construction and maintenance of roads and runways.

The intention of the study is to assess trends in demand for bitumen over the next 10 years and the impact of such on the production capacity. This information will be used to generate discussion amongst relevant stakeholders in the near future.

To this end Sabita has been requested to provide information on projected demand and supply capacity over the period from 2007 to 2016.

## **2. Introduction to Sabita**

The Southern African Bitumen Association was established in 1979 as a non-profit organisation. Sabita is funded by its members who comprise of private companies from the primary producers of bitumen to secondary manufacturers and applicators of bituminous materials and consulting engineers.

The main goal of Sabita is to promote the excellence in the use of bituminous materials. In support of this objective Sabita strives to:

- Advance best practice in southern Africa with due regard to worker health and safety as well as the conservation of the environment.
- Provide education and training schemes to develop skills and competencies that are sustainable and aligned to national goals and frameworks;
- Engage government to promote the social and economic value of road provision and efficient delivery by state road organisations.

Further information on Sabita and it's activities can be found on [www.sabita.co.za](http://www.sabita.co.za) The contents of this paper has been reviewed by all the primary producers of bitumen in South Africa and their comments have been incorporated.

### 3. Overview of bitumen supply

South Africa has 4 oil refineries which import crude oil with the main purpose of manufacturing petrol and diesel fuel for motor vehicles and trucks. The residue from the crude oil refining process is used to manufacture bitumen. The percentage manufactured into bitumen varies between 1 and 4 % of the crude oil through put. This percentage is mainly dictated by local demand for bitumen and to a lesser extent export opportunities. The remaining residue not used for manufacturing bitumen is further processed and sold as bunker fuel oil for ships or as heavy furnace heating fuel. The coastal refineries process the majority of the residue (typically between 15 and 25%) as bunker fuel oil. Table 1 below indicates the bitumen produced by refinery as a percentage of crude oil through put.

| Refinery       | Location  | Daily crude through put (tons) | Bitumen % of crude | Bunker fuel oil market |
|----------------|-----------|--------------------------------|--------------------|------------------------|
| <b>Chevron</b> | Cape Town | 15,000                         | 1.2                | Yes                    |
| <b>Engen</b>   | Durban    | 16,000                         | 4.1                | Yes                    |
| <b>NATREF</b>  | Sasolburg | 15,000                         | 3.1                | No                     |
| <b>SAPREF</b>  | Durban    | 24,500                         | 1.1                | Yes                    |

The coastal refineries manufacture bitumen on a continuous basis as a consequence of fuel and lubricant refining, whereas the inland refinery on the other hand manufactures bitumen by going into a dedicated bitumen mode which results in a reduced yield of fuel. This means that Natref can manufacture fuels without producing bitumen whereas the coastal refineries are configured to always produce a residue which can be further processed into bitumen given that suitable crude types are always used.

In the past bitumen production capacity has exceeded local demand and thus South Africa is a net exporter of bitumen. Surplus bitumen is exported mainly to the Indian Ocean Islands. With over 60% of the bitumen production capacity located in Durban and the resultant supply exceeding local demand, Durban based Oil Companies have resorted to exporting the majority of their bitumen.

The table 2 below indicates the supply of bitumen by refinery during 2006.

| Refinery       | Local (tons)   | Export (tons)  | Total (tons)   | % total    |
|----------------|----------------|----------------|----------------|------------|
| <b>Chevron</b> | 54,000         | 0              | 54,000         | 11         |
| <b>Engen</b>   | 68,000         | 130,000        | 198,000        | 42         |
| <b>NATREF</b>  | 134,000        | 6,000          | 140,000        | 30         |
| <b>SAPREF</b>  | 52,000         | 28,000         | 80,000         | 17         |
|                | <b>308,000</b> | <b>164,000</b> | <b>472,000</b> | <b>100</b> |

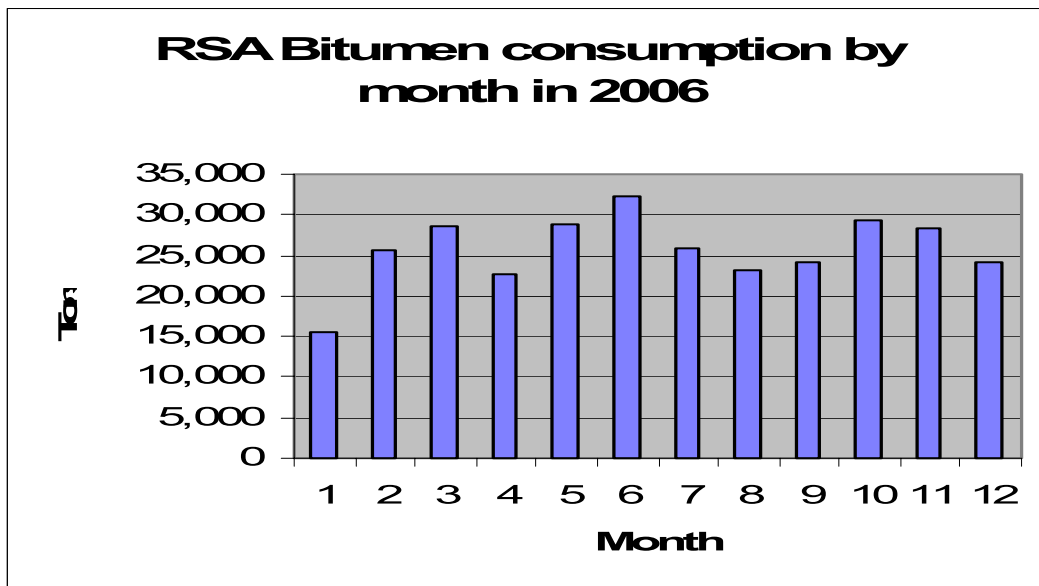
#### 4. Overview of bitumen demand

##### 4.1 South African demand for bitumen.

The local demand for bitumen has declined since the late 1980's, when an annual volume of up to 400,000 tons was consumed. In more recent years the demand has fluctuated around the 250, 000 ton mark. However, we experienced a dramatic increase of 17.5% in the local demand for bitumen in 2006 compared with the previous year, which is in line with increased spending on road construction and maintenance projects. This compares favourably with Government's planned growth in Medium Term Expenditure Framework of 25% per annum over the next 3 years.

Approximately 90% of bitumen is used in government funded road and runway projects with small amounts being used in private roads, parking areas and industrial applications. The demand for bitumen within any 12 month period will fluctuate and the demand is dictated mainly by the factors which are beyond the control of the bitumen suppliers.

Figure 1 below shows the variability in the local consumption of bitumen by month for 2006.



The main reasons for the monthly fluctuations are discussed below and some recommendations are made to help reduce spikes in demand and thus improve supply conditions.

1. **Seasonal climatic conditions.** The application of bituminous materials is restricted to periods of dry warm weather conditions. This causes daily as well as seasonal fluctuations in the demand for bitumen by region depending on the prevailing local climatic

conditions. The effect of the colder weather on demand can be seen in Figure 1 for the winter months of July, August and September. For example very little bituminous work is done during the winter months in the Western Cape.

*Road authorities should be encouraged to make more use of cold applied bituminous materials such as bitumen emulsions which are not as temperature dependant. We have seen the demand for bitumen emulsions decline dramatically over the past 10 years in favour of cheaper hot applied bitumen binders.*

2. **Financial year end.** Most road authorities and in particular municipalities tend to hold back on road maintenance expenditure until closer to their financial year end before issuing orders for the resurfacing of their roads. This places a huge burden on resources and material supply over a short period. This can be clearly seen in Figure 1 with the demand for bitumen peaking in the months of May and June which coincide with Municipal year end on 31 June.

*Municipalities and Provincial road authorities should spread their periodic maintenance resurfacing work through out the year by extending the budget period of say 24 months to allow sufficient time for planning and implementation of projects.*

3. **Annual construction shutdown.** The construction industry shuts down for one month over December and January for their annual holidays. In all the regions this is the most suitable time of the year from a weather perspective to conduct bituminous works. However, even if contractors decided to work over this period they are prohibited to work on certain roads because of high traffic volumes. The effect of public holidays on bitumen consumption can be seen in Figure 1 for the months of December and January with the holidays in April also impacting negatively on bitumen offtakes.

*By reducing the annual construction shutdown period to between Xmas and New Year public holidays and allowing workers to take leave in mid winter would lead to improved productivity by allowing contractors to make use of the longer working hours in the summer months. Moratoriums placed by some Road Authorities on the cessation of road works over the Easter holiday period should also be critically reviewed and not be enforced as a norm.*

## **4.2 The export demand for bitumen.**

The demand for bitumen in the neighbouring SADC territories varies but is relatively small and is estimated at approximately 60,000 per annum. This demand fluctuates in line with the level of foreign funded road projects in the neighbouring territories. The only other local sources of bitumen supply in Sub Saharan Africa are the Ndola (Zambia) and Mombassa (Kenya) refineries. The supply of bitumen from these refineries is known to be erratic and the quality sometimes questionable.

The supply of bitumen into neighbouring countries is normally done in hot bulk road tankers. Off shore customers are normally supplied in hot bulk by dedicated ships which are loaded by road tanker at the port. The supply of bitumen for export by ship requires large stocks of bitumen to be built up and hauled over a short period to fill the ship.

Sometimes there is a demand for smaller quantities to be supplied in drums or containers. The latter orders are secured through export traders whilst the bulk shipments are often linked to long term supply contracts.

## **5. Factors effecting future supply**

### **5.1 Short term – next 12 months**

Notwithstanding the recent increase in bitumen demand, supply problems were experienced with both Sapref and Natref. Sapref experienced a fire during their start up after their planned shutdown last year and have been down since October. Natref have been operating below half of their normal production capacity since the end of December due to damage caused to one of their bitumen crude tanks from a lightening strike. These were both unplanned events and such events will always impact negatively on the availability of bitumen in the short term and can lead to a delay in the completion of projects.

The situation at Natref is expected to impact negatively on supplies in the short term as Natref will not be able to build up any stocks for their planned shutdown scheduled from 8 May to 16 June 2007. Sapref are currently able to manufacture limited quantities of bitumen and will continue to do so until they are back to full production by the middle of April 2007. Calref have also planned a shutdown from 19 March until 30 April 2007 during which time they will be installing two new bitumen loading arms. In the period leading up to their shutdown Calref will build up sufficient bitumen stocks to keep their customers 'wet' during their shutdown period. Engen are planning to shutdown from 4 June to 6 July 2007. They also do not anticipate any disruptions in the supply to their customers in the local market over this period. However they are not

currently in a position to assist Sapref and Natref, who have been experiencing problems with supply, due to their export commitments.

There is a concern that unless the Durban refineries are able to cover the shortfall in the inland demand over the next few months, until after the Natref shutdown in the middle of the year, then there could be a shortfall of +/-20,000 tons of bitumen.

**Other factors affecting short term supply of bitumen are:**

**1. Scheduling of shutdowns.** The close proximity of the planned refinery shutdowns mentioned above does not bode well for the supply of bitumen as these shutdowns often over run their scheduled start up date due to unforeseen problems and could lead to shortages in bitumen.

*Whilst it would be more desirable for the consumers of bitumen that the refineries spread their planned shutdowns over the year, it is unavoidable as these shutdowns are scheduled to accommodate the international expertise which is required to carry out the specialist maintenance works during such shutdowns. The refineries should be discouraged from exporting bulk shipments of bitumen when another refinery has a planned shutdown and especially if this also falls during high peak demand period.*

**2. Limited storage and loading capacity.** Due to the decline in past volumes there was a concomitant under investment in upgrading the bitumen dispatching facilities to enable the refineries to cope with the sudden increase in peak demand.

*The refineries should be encouraged to take measures to increase the dispatching capacity of bitumen to improve the turnabout time of the road tankers at the refineries.*

**3. The loading of bulk bitumen into ships.** The loading of bulk bitumen into a ship at the wharf places a high demand on the road transport and refinery resources due to the short period allowed for loading.

*The erection of a bulk storage tank at the wharf would reduce the peak demand as the stocks level of the wharfside tank can be built up over a longer period thus alleviating congestion of road tankers during loading and free up existing storage tankage at the refinery.*

The table 3 below indicates the bitumen manufacturing potential of each refinery which can be achieved without any major increase in processing capacity.

| Refinery       | Actual 2006 sales (tons) | Bitumen % of crude | Potential capacity (tons) | Bitumen % of crude |
|----------------|--------------------------|--------------------|---------------------------|--------------------|
| <b>Chevron</b> | 54,000                   | 1.2                | 105,000                   | 2.3                |
| <b>Engen</b>   | 198,000                  | 4.1                | 240,000                   | 5.0                |
| <b>NATREF</b>  | 140,000                  | 3.1                | 140,000                   | 3.1                |
| <b>SAPREF</b>  | 80,000                   | 1.1                | 240,000                   | 3.3                |
|                | <b>472,000</b>           | <b>2.3</b>         | <b>725,000</b>            | <b>3.4</b>         |

The above volumes are based on the current processing capacity of the distillation units and assuming that there is sufficient storage capacity and loading facilities in place to dispatch the bitumen.

## 5.2 Medium term - 2008 to 2010

If we assume the production capacities in table 3 and that:

- There is no increase in existing export volumes
- Refineries increase investment in storage tanks and loading capacity
- Natref continue to produce bitumen albeit at the same production rates

then there would be 253, 000 tons per annum spare capacity to meet increased local demand with a maximum supply capacity potential of 561, 000 tons for the local market.

Table 4 below illustrates how the local market demand will exceed supply, depending on the growth in local demand and assuming a supply capacity of 561,000 tons per for the local market.

| % Growth rate | 2007 | 2008       | 2009       | 2010       |
|---------------|------|------------|------------|------------|
| 15            | 354  | 407        | 468        | <b>539</b> |
| 20            | 370  | 444        | <b>532</b> | 639        |
| 25            | 385  | <b>481</b> | 602        | 752        |

If the growth rate exceeds 17 % per annum then we will reach supply capacity by the end of 2010 which will then necessitate further investment in refining processing capacity to cope with any increase in demand. The above assumes that short term spikes in demand are minimized through extending working periods (as suggested in section 3) and increasing customer storage capacity in order to improve productivity.

### **5.3 Longer term - 2011 to 2016**

Based on the more recent trends in bitumen demand experienced prior to 2006 it would be reasonable to assume that the growth in the local demand for bitumen in the post 2010 period would likely be closely linked to and follow the growth in GDP over this period.

However, the demand for bitumen will only continue to grow beyond 2010 if government embarks on a programme of ongoing road maintenance to preserve the asset value of the road network. Understandably the demand up to 2010 will be driven largely by the need to meet the infrastructure needs for hosting 2010 World Cup Soccer. If proper life cycle planning is done in terms of the Government's Immovable Asset Management Bill [GIAMA] then we can realistically expect there to be an ongoing increase in demand for bitumen albeit at say a lower rate. In the latter case this will require a further investment in bitumen distillation, blending and dispatch facilities at all the refineries to cope with longer term demand.

### **6 General comments**

All the crude oil refineries in South Africa are primarily designed and built to produce fuels. Thus any legislation concerning cleaner fuels could impact negatively on the production of bitumen mainly through placing restrictions on the overall refinery processing capacity. The logical measure would be to look at means of streamlining the operations pertaining to the exporting bitumen to minimise the impact on local supply, especially to offshore locations before we increase our investment in expanding bitumen refining capacity.

There are a limited number of refineries in the world whose primary function is to produce bitumen but the economies of scale in South Africa do not warrant an investment in a dedicated bitumen refinery. South Africa only consumes about 0.25% of the world's bitumen and the distance from large markets would make us uncompetitive as an exporter of bitumen.

### **5.1 The future position of Natref towards refining bitumen**

Given the uniqueness of Natref in comparison to the coastal refineries, there is a possibility that Natref could reduce the amount of bitumen it manufactures and focus on optimising their fuel production. This would mitigate the need to make further investments to increase Natref's fuel production capacity. At the moment Natref manufacture bitumen at the expense of manufacturing fuel and are thus obliged to import any shortfalls in fuels whilst continuing to produce bitumen. It is uncertain how long the shareholders of Natref will continue to do so. This would mean

that the Durban refineries would have to substantially increase their bitumen production capacity to supply any shortfall in demand in the inland market.

## **5.2 Exporting of bitumen**

The neighbouring countries of South Africa are to a large degree dependent on South African refineries to supply their bitumen needs. Bitumen could be imported to these territories from alternative sources albeit at a higher landed cost. In the case of land locked countries like Lesotho, Swaziland and Botswana, it would be impractical from a logistical point of view. Many South African companies operate in these countries and have relied on work from these territories in the past to sustain their business operations. Neighbouring countries with harbours can be serviced by imports of bitumen by container, drums or bulk if they erect wharftankage.

The export of bitumen to the Indian Oceans Islands is normally negotiated as part of a long term supply contract. Alternative sources of supply are available however there could be some cost implications. However all Oil Companies should be made aware of the potential supply shortage of bitumen and be discouraged from entering into large volume long term export contracts for bitumen.

## **5.3 Importing of bitumen**

The local road building industry has evolved around handling bitumen in hot bulk. Thus, for the shortfall in supply to be supplemented by importing hot bulk bitumen, an investment in dock side bulk tankage would be required. However, it is doubtful that suitable sites exist at our ports. Furthermore the erection of such a facility would require a substantial investment. It is also doubtful that such an investment would be viable given that it would only be utilised when ever there was a shortage in South Africa as the landed cost of imported bitumen would be more expensive than locally produced product. The likely sources of such bitumen would be from the Middle East where our crudes are sourced. The cost of shipping and handling hot bitumen exceeds that for importing crude oil. The imported bitumen would have to comply with specifications which are unique to South African conditions and could thus attract a premium in price.

## **6 Conclusion**

Along with other resources, bitumen is a key ingredient material in the construction and maintenance of surfaced roads. Therefore, the sustained supply of bitumen is critical to ensuring that the Government

achieves its objectives of infrastructure provision which are crucial for the envisaged economic growth in South Africa.

We trust that this position paper will provide some insight into the challenges which the bitumen industry faces in meeting the future supply of bitumen. The recommendations made are for discussion purposes and should not be seen in isolation as they could have knock on ramifications in other areas not discussed. In the same context the future tonnages are estimates only and are given to sensitise the reader to the reality of the future situation we face so that the necessary action can be taken to avoid a shortfall in supply. With all things being equal there is sufficient inherent refining capacity to meet the future demand for bitumen by processing increasing percentages of residual crude oil. However, this would have to be coupled with an increased investment in blending and dispatching facilities at all the refineries and improved optimisation of surplus production capacity for exportation of bitumen without impacting negatively on local supply.

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