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# THE FUTURE OF SOUTH AFRICAN COAL: MARKET, INVESTMENT, AND POLICY CHALLENGES

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A focus area is research on regulatory, institutional and financial mechanisms that promote widened access to infrastructure services. He has also done work on financial mechanisms and business models that facilitate the introduction of energy efficiency and renewable energy.



# The Future of South African Coal: Market, Investment and Policy Challenges

Anton Eberhard

## 1. Introduction

South Africa is a significant participant in global coal markets. However, it is not the biggest: China, the USA and India are much larger producers and consumers of coal; Australia, Indonesia, Russia and Colombia are larger exporters. Yet, South Africa's coal industry is noteworthy in a number of respects: it is a relatively low cost producer (along with Indonesia and Colombia), has the world's largest coal export terminal, and is positioned conveniently between Atlantic and Pacific coal markets. It is a potential swing producer, able to export competitively to either Europe or the East.

South Africa has substantial coal reserves and there is scope for expanding its coal exports, thereby generating much needed export earnings and reducing the country's negative trade balance and current account deficit. However, increased coal exports face serious barriers and obstacles, including inadequate rail capacity to the coast. There is a lack of planning and investment coordination between privately owned mines, state-owned rail infrastructure and port capacity.

South Africa is also a major consumer of coal, mainly for electricity production. It also operates the world's only commercial coal synfuel (CTL) plants. It is amongst the twenty most carbon-intensive economies in the world but does not yet face any binding international treaty obligations to reduce its greenhouse gas emissions. Nevertheless, global warming and other environmental concerns are beginning to constrain further local coal-based investment decisions. In the Copenhagen Accord, South Africa made a voluntary commitment to reduce its greenhouse gas emissions below a business-as-usual scenario.

This paper explores the interplay between South Africa's domestic and export thermal coal markets and what might shape their development in the future. The paper first examines the industrial organisation and political-economy of the coal sector in South Africa. An overview is provided of coal mining companies, how the current market structure emerged historically, the development of rail and port facilities, and coal costs and prices. Policy and legislative developments are also described. Finally scenarios are developed for local and export coal markets.

The coal sector in South Africa offers both challenges and opportunities. It remains to be seen whether South Africa will develop integrated policy and regulatory frameworks, and more purposeful investment strategies and programmes, that will set the country on a sustainable development path while maximising potential export benefits.

## 2. Overview of South African coal sector

South Africa's global position in terms of hard coal production has slipped and it now ranks sixth, behind China, USA, India, Australia and Indonesia. Total coal output in 2009 was 247 million tonnes (Mt). It ranks fifth as a hard coal exporter, behind Australia, Indonesia, Russia and Colombia.<sup>1</sup> Its exports totalled 67 Mt in 2009 (IEA, 2010).

*Table 1: 2009 Global hard coal production and exports in Million Tonnes Coal Equivalent (Mtce)*

Producers	Mtce / annum	Exporters	Mtce / annum
China	2 971	Australia	262
USA	919	Indonesia	230
India	526	Russia	116
Australia	335	Colombia	70
Indonesia	263	<b>South Africa</b>	<b>67</b>
<b>South Africa</b>	<b>247</b>	USA	53
Russia	229	Canada	28
Kazakhstan	96	Vietnam	26
Poland	78	China	23
Colombia	73	Kazakstan	23
Rest of World	253	Rest of World	47
<b>World</b>	<b>5990</b>	<b>World</b>	<b>944</b>

Source: IEA (2010)

South Africa's economically recoverable coal reserves are estimated at between 15 and 55 billion tonnes. 96% of reserves are bituminous coal; metallurgical coal accounts for approximately 2% and anthracite another 2%.<sup>2</sup> Production is mainly steam coal of bituminous quality. The majority of South Africa's reserves and mines are in the Central Basin which includes the Witbank, Highveld and Ermelo coalfields (see Figure1 and Appendix1). Coal production in the Central Basin is likely to peak in the next decade. The Waterberg coalfield is the focus of recent exploration efforts and could become a major coal mining center in the future, subject to infrastructure and water constraints. Production in this area will double in the next 5 years. Other coalfields in the Limpopo Province are also being explored, with a focus on coking coal.

Coal seams are relatively thick and close to the surface, which allows for low-cost mining; a quarter of South Africa's bituminous coal is between 15-50 m below the surface and much of the remainder between 50-200m. Half of reserves are in seams 4-6m thick and a further third in 2-4m seams (Petrick Commission, 1975). Approximately half of production comes from opencast mines, and the balance from underground mines. Ash contents vary, but are high and can range up to 65% in the Waterberg field. Export grade coals generally require washing

<sup>1</sup> The USA also ranks as an exporter although more than half of its exports are coking coal. Australia, Indonesia and Russia also export significant quantities of coking coal. Nearly all of South Africa's exports are steam coal.

<sup>2</sup> The Department of Minerals and Energy, in its South Africa's Mineral Industry 2001/2 Report, estimated economically recoverable coal reserves at 55.3 billion tonnes. This figure is based on the Bredell Report (1987). The earlier Petrick Commission (1975) estimated reserves at 53.9 billion tonnes and De Jager (1982) at 58.4 billion tonnes (Alberts, 1987). Prevost of the Minerals Bureau downgraded the reserves to 39.1 billion tons in 2000, but that was during a period of declining coal prices in real terms, and one of largest coal deposits was uneconomic at the then ruling prices. The BP Statistical Review of World Energy puts South African coal reserves at 30.4 billion tonnes. Hartnady (2010) calculates remaining reserves to be 15 billion tonnes.

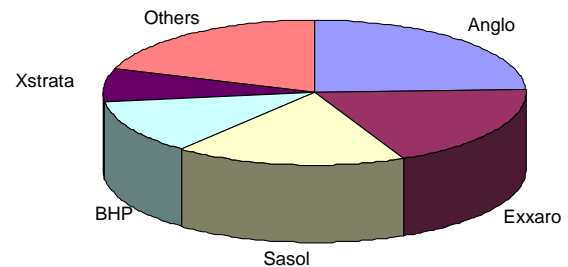
so that their ash content does not exceed 15%. Heating values of export coals of around 6200 kcal/kg (26 MJ/kg), net as received, were common, but average values are declining and some export coals are now around 5900 kcal/kg (24.7 MJ/kg). Sulphur contents are generally between 0.6-0.7%. Thermal coals used for domestic power and synfuel production have much lower calorific, and higher ash, values and are supplied mostly from screened run-of-mine production (although about a third of the coal supplied for electricity production derives from the middlings fraction from coal washing).

A further by-product of coal washing or beneficiation is large quantities of discard or “duff” coal which now amounts to over one billion tonnes and is being added to at the rate of about 60 million tonnes per annum (Mtpa). This presents both an environmental challenge as well as a potential resource for power production using fluidized bed combustors, although, as Lloyd (2000) notes, the coal is referred to as discard for a reason: it is of poor quality (high ash and sulphur) and volatiles diminish as stockpiles age.

Figure 1:  
South African major coal fields



Figure 2: Share of production:  
South African coal producers

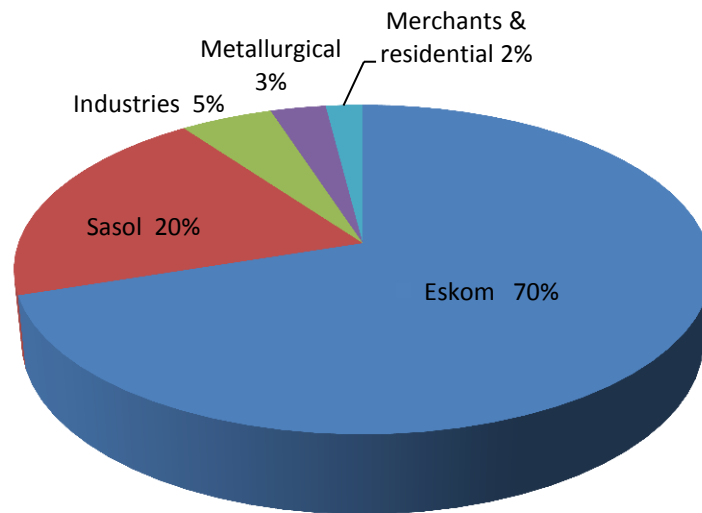


A large proportion of the steam coal for export and domestic markets is produced by eight mega-mines, with a production of more than 10 Mtpa each, seven of them in the Central Basin. The remaining large mine is in the Waterberg.<sup>3</sup> Five companies account for about 80% of coal production in South Africa: Anglo-American, Exxaro, Sasol, BHP Billiton and Xstrata (Figure 2).

<sup>3</sup> A large proportion of exports come from the Witbank coalfield. Much of the No 2 seam, and a portion of the No 4 seam, is exported as steam coal. Witbank’s No5 seam also produces metallurgical coal. Many of the new mining licences for small miners have been granted in this coal field. Some of these junior miners produce run-of-mine and sell to traders who organise washing and exports. The Ermelo field has more broken seams and much of the coal is not export quality, although a proportion of its No 4 seam is exported. Mining of the Highveld coal field is concentrated on the No 4 seam, much of which supplies Sasol’s CTL plants. The Waterberg produces mainly washed steam coals as well as small quantities of coking and metallurgical coals. The KwaZulu Natal area has only four small mines, all producing anthracite. The Province’s previously operating mines, including some producers of hard coking coal have mostly closed down. The Vereeniging-Sasolburg Coalfield has two steam coal mines, both with the lowest coal quality in the country.

Just over two thirds (by mass) of domestic coal consumption is for electricity generation by Eskom, the national power utility. Coal-to-liquid-fuel (CTL) plants, operated by Sasol, account for another fifth of coal consumption. Small merchants, who supply mainly residential users and small businesses, account for about 2%, metallurgical industries about 3% and cement, chemical and other industries consume the remaining 5% (DMR, 2009).

Figure 3: Coal use in South Africa (excludes exports)



Source: Prevost (2010)

Coal thus plays a vital role in South Africa's energy-economy: it accounts for 70% of primary energy consumption, 93% of electricity generation and 30% of petroleum liquid fuels. However, coal production and use also results in a number of serious environmental impacts. While greenhouse gas emissions and climate change loom large in the future (and will be discussed in detail later in the paper), a number of other coal mining related environmental problems are emerging. Perhaps the most serious immediate environmental problem is that of acid mine drainage. Mining breaks up the rock mass, allowing free access of water and sulphuric acid-producing reactions between iron sulphide (pyrite), present in the coal and its host rocks, and oxygen-bearing water. Acidic water dissolves aluminium and heavy metals, including iron and manganese, which are toxic to animal and most plant life. In bord and pillar mining only the pillars come into contact with water. Longwall mining, where the roof is allowed to collapse into the mined out void, increases the contact area and also facilitates the ingress of rain water. In opencast mining the rock mass is completely fragmented, maximising the contact between water and rock, and is therefore the most acid producing mining method. Acid mine drainage acidifies soil and rivers. Destruction of biodiversity, reduced agricultural production, soil erosion, and serious water pollution are now evident in the Olifants River and are beginning to emerge in the Vaal River catchment.



Environmental studies indicate that further large scale development of coal fields, especially in the central basin, could result in irreversible and costly environmental damage and could prejudice the quality of scarce and essential water resources in South Africa's most productive economic region (McCarthy & Pretorius, 2009).

Acid mine drainage is less of a problem in the Waterberg because of low rainfall and less water ingress. Here the problem is the opposite – one of water shortage. However, that gives rise to another set of environmental constraints; insufficient water could limit large-scale development of the Waterberg coalfields.

### **3. Historical development of sector**

The current market structure of South Africa's coal industry, with its five dominant production companies, has its historical antecedents in the development of mining and industrial policy over the past 120 years. Coal, and later coal-fired power stations, provided the energy for diamond and gold mining and associated industry and infrastructure, including the railways. For the first half of the twentieth century, nearly all coal mines were owned by gold-mining houses.

Anglo-American, for many years South Africa's largest company, has its origins in gold mining and remains a major coal producer.

Another multinational company currently involved in the coal sector in South Africa, Xstrata, has its origins not only in Swiss capital (Glencore) but also Lonrho's mining interests in Southern Africa (Duiker Mining).

The third major current coal company, BHP Billiton, stems in part from General Mining or Gencor (which absorbed TransNatal collieries and Rand Mines), which became Billiton, which later merged with Australia's BHP. After the Afrikaner nationalists came into power in 1948, there was a conscious attempt to bolster Afrikaner capital as a counterweight to English "colonial" mining capital. Gencor was one of the products of this initiative.<sup>4</sup>

The other current South African coal major, Exxaro, also owes its origins to overt empowerment politics, but of a different kind. After the democratic revolution of 1994, policies were initiated to promote black economic ownership. Exxaro came about from a merger of Eyesizwe and certain Iscor/Kumba interests. The former was created from divested coal assets from Anglo and BHP, and the latter from the coal division of Iscor, the national iron and steel company, created originally by the old nationalist government.

A series of cartels initially controlled the industry, including the Transvaal Coal Owners Association (TCOA), which was formed in 1908, the purpose of which, in the words of the President of the Transvaal Chamber of Mines, was "to put an end to what was considered in some quarters a ruinous competition" (Marquard, 2007: 79). The TCOA, along with the Natal

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<sup>4</sup> Gencor/Billiton's South African coal company was previously known as Ingwe.

Associated Collieries (NAC), was highly influential in helping to shape state policy for the coal industry at the time.<sup>5</sup>

Until the 1940s, between a sixth and a third of annual coal tonnage was exported. However, contemporary doubts on the extent of reserves, and the imperative of supplying local demand, led to the state imposing restrictions on exports, which dropped to around 2% of production between 1950 and 1970. During this period, the state also imposed price controls on the domestic market with the aim of promoting industrialisation through cheap energy inputs. The regulated price was set using a rate-of-return methodology which did not recognise depreciation costs, resulting in amongst the lowest coal prices in the world (Marquard, 2007). The consequences of this pricing policy were low profitability, limited investment and inefficient mining techniques.

Coal mines in South Africa initially had relatively low levels of mechanisation and extraction rates. The wasteful bord and pillar mining method was common and more than half of the coal resource was left in the ground. Low wages and low domestic prices provided few incentives for investment and technology development.

The 1970s saw a new era in the development of South Africa's coal industry with expanded investments in electricity generation, synfuels and coal exports.<sup>6</sup> These investments were spurred by higher labour costs, following increased unionisation, and changes in government policy which promoted mechanisation, domestic energy security and increased exports.

Mechanisation replaced hand-loading and facilitated the introduction of open-cast mining. The first mechanised dragline was introduced in Gencor's Optimum mine in 1970. Labour productivity and coal extraction rates increased substantially. "Continuous miners" and long-walling<sup>7</sup> were introduced later. Coal output more than doubled between 1970 and 1980, and quadrupled by the end of the century.

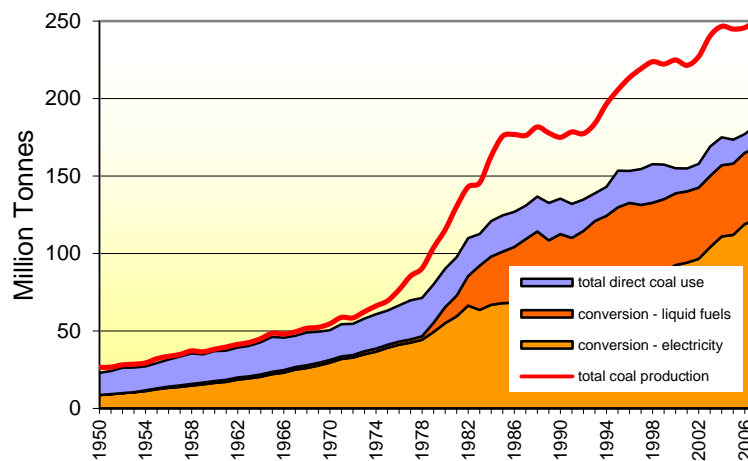
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<sup>5</sup> Teams from the NAC and TCOA constituent members undertook joint export marketing trips, placing what were then relatively modest volumes of coal in the export market. The TCOA and NAC ceased to operate in domestic markets in the 1980s but the TCOA remained a key channel for exports for many years thereafter, albeit with a reduced number of shareholders (Anglo, BHP-Billiton and Goldfields Coal which were subsequently absorbed into Anglo and split across Anglo and Eyesizwe). Japanese, Korean and Benelux steelmakers, one Japanese utility and the National Coal Supply Corporation of Israel were the principal customers at that time. All TCOA facilitated export supply contracts have since been terminated and the dormant entity was eventually wound up in 2009.

<sup>6</sup> Prof David Horsfall at the University of Witwatersrand played a seminal role in the growth of the coal export industry. He demonstrated that coal could be washed successfully to produce a higher quality coal that could earn higher export earnings.

<sup>7</sup> Long-walling technology has found application in only a couple of coal mines in South Africa and less than 5% of the underground production is won in this way.

Figure 4: South African coal production, consumption and exports: 1950-2007



Source: Marquard (2007)

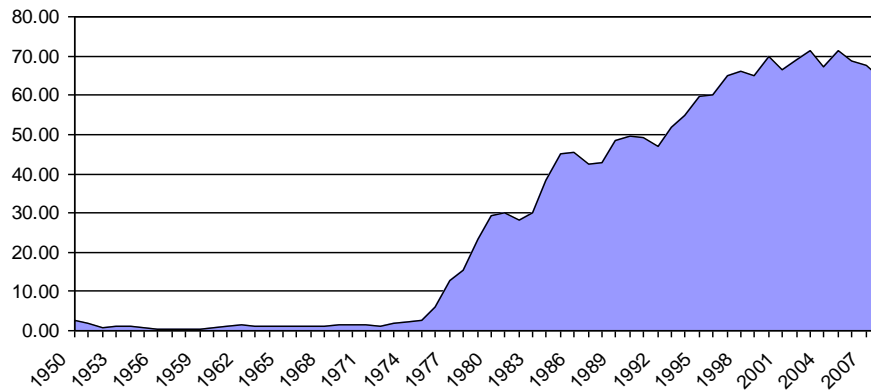
The expansion of South African coal exports were catalysed by a contract signed in 1971 between the Transvaal Coal Owners Association (TCOA) and seven Japanese steel mills for 27 Mt of blended coking coal over a ten year period. Exports started at 100,000 tonnes per annum in late 1972 and increased to 2.7 Mt from 1976 to 1986.

Engineers at Anglo-American developed a two stage washing process that economically produced both a low-ash coking coal and large quantities of high-grade steam coal, which could not all be absorbed on the domestic market and thus created an added incentive for expanding exports.

The 1973-4 oil crisis created an opening for South African coal exports into Europe. Given the higher prices and profits in coal exports, industry began to lobby for increased export allocations which were subsequently granted.

However, existing rail and port facilities at the time were a major bottleneck. A condition of the Japanese coking coal contract was the development of new port that could handle larger bulk carriers. Agreement was reached between the TCOA and the government to expand rail capacity and to build a new port at Richards Bay. Both were planned for greater capacities than the Japanese coking coal contract. The TCOA exporters were required to guarantee the financing of the railway line, plus adequate loads. Shareholders also financed, built, and continue to manage, the coal handling facilities at Richards Bay, which was opened in 1976 with a capacity of 12 Mtpa. Extensive cooperation between the state and key industry players made this development possible. Exports expanded significantly as step changes were made in rail and port capacity (Figure 5). Export permits were eventually abolished in 1991.

Figure 5: South African coal exports Mtpa (1950-2008)



Source: Marquard (2007)

The high potential value of exports was seen as critical to the development of the South African coal mining industry, including more efficient extraction rates and possible cross subsidizing of cheaper, lower grade coal to the domestic market.

Following years of intensive lobbying by the coal industry, domestic wholesale and retail coal prices were progressively increased and finally deregulated in 1986. Pithead prices were deregulated in 1987.

The domestic market grew substantially as the national electricity utility, Eskom, embarked on an ambitious capacity expansion programme in the 1970s and 80s. At the same time, Sasol<sup>8</sup> invested in new coal to liquids (CTL) or synthetic fuel plants.

The end of apartheid in 1994 accelerated the internationalisation of South Africa's coal industry. Collieries which had previously functioned as divisions within gold mining houses were restructured into separate subsidiaries with their own local and overseas marketing operations. As global commodity markets expanded, there were clear strategic and efficiency advantages for multinational companies to create and manage global coal (and other commodity) businesses that stretched across countries, rather than country specific multi-product businesses.

The most recent significant regulatory development in the coal mining industry in South Africa has been black economic empowerment deals which have seen not only the creation of the coal major, Exxaro, but also a host of smaller black-owned companies which are competing for a share in domestic and export coal markets. Together, black-owned coal companies now control more than 30% of South African coal production (Prevost, 2010).

<sup>8</sup> Sasol was founded by the South African state in 1950 with the object of commercialising coal-to-liquids technology. Its first plant was commissioned in Sasolburg in 1955. After the oil price shocks in the 1970s, and sanctions against the Apartheid government, two much larger plants were built at Secunda, in the Mpumalanga Province, in 1980 and 1982.

## 4. Industrial organisation and economics

All coal mining in South Africa is undertaken by private companies. The main coal port at Richards Bay is also controlled by private shareholders. However, the railways from the mines to the ports are controlled by a state-owned monopoly, Transnet.

As we have seen, local coal use is dominated by Eskom, the state-owned power company, and by Sasol, the large synthetic fuels company which was started by the state but was later privatized. Sasol owns its own coal mines, while Eskom relies mainly on long-term contracts with adjacent private mines owned by the four coal majors. Eskom's favorable supply arrangements with dedicated coal mines are increasingly under threat as mines divert higher quality coals for export and as higher electricity demand, and hence also coal usage, exposes it to supplementary short term contracts, not only with the coal majors, but also with a variety of small mining companies.

### 4.1 Coal producers

#### *Anglo American*

Anglo American is South Africa's largest coal producer. It is also one of the world's largest diversified mining groups. Its Anglo Coal Division has operations in South Africa, Australia, South America and Canada. It owns and operates eight mines in South Africa. Four are in the Witbank coal field (Goedehoop, Greenside, Kleinkopje and Landau) and these supply some 20 Mtpa of predominantly thermal coal, mainly for export markets, but also smaller amounts to local industries. These mines also produce about 1 Mta of metallurgical coal for export. In addition, Anglo operates a number of dedicated mines for Eskom. The Kriel and New Denmark (Tutuka) mines in Mpumalanga Province, and the New Vaal (Lethabo) mine at Vereeniging, have cost-plus, long-term contracts with Eskom, while the Mafube (Arnot) mine, also in Mpumalanga, is 50% owned with Eyesizwe<sup>9</sup>, and has a long term indexed-price Eskom contract. Anglo's Isibonelo mine supplies a relatively small portion of Sasol's needs on a long term fixed (indexed) price contract.

In 2008, Anglo Coal produced 59.4 Mt, of which 36.2 Mt was sold to Eskom and 5 Mt to Sasol. It has an export entitlement<sup>10</sup> of 19.8 Mtpa through the Richards Bay Coal Terminal, although actual exports have been slightly lower at around 16 Mtpa (Anglo American Annual Report, 2008).

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<sup>9</sup> Anglo has an 11% interest in Eyesizwe Coal, a black economic empowerment venture which was the outcome of Anglo buying Goldfields Coal, splitting those assets, retaining Greenside, and combining New Clydesdale and half of Matla (ex Goldfields) with the other half of Matla (ex BHP Billiton) plus Arnot into Eyesizwe. Eyesizwe then linked its assets with a package of assets that emerged from the Iscor Kumba split to form what is today Exxaro.

<sup>10</sup> Exports are mainly via the private-owned Richards Bay Coal Terminal and export entitlements are determined according to the relevant size of the company's shareholding and the total terminal capacity.

Table 2: Anglo Coal mines in South Africa

Mine	Opencast U/ground	Coal field	Main Market	Mt 2007	Mt 2008
Goedehoop	U	Witbank	Export	8.5	7.5
Greenside	U	Witbank	Export	3.3	3.4
Kleinkopje	O	Witbank	Export	3.5	4.5
Landau	O	Witbank	Export	4.6	4.5
Kriel	U	Witbank	Eskom Kriel	11.2	10.3
New Denmark	U	Highveld	Eskom Tutuka	5.1	5.2
Mafube	O	Witbank	Eskom Arnot	.8	1.7
New Vaal <sup>11</sup>	O	Vereeniging- Sasolburg	Eskom Lethabo	17.1	17
Isibonelo	O	Highveld	Sasol	5	5.3
<b>TOTAL</b>				<b>59.1</b>	<b>59.4</b>

Source: Anglo American Annual Report 2008

Mafube is ramping up production and will eventually produce 5.4 Mtpa. New Anglo projects include Zondagsfontein (6.6 Mta), a multi-product mine, jointly undertaken with BHP Billiton, supplying both Eskom and the export market; Mac West (2.7 Mta), an extension of the New Vaal colliery; and New Largo which, along with Zondagsfontein, will supply up to 17 Mtpa to Eskom's new 4500MW Kusile power station near Witbank over its 47 year life. In 2007, Anglo Coal announced the creation of Anglo Inyosi Coal, a broad-based economic empowerment (BEE) company valued at approximately US\$ 1 billion. Anglo-America owns 73% of Anglo Inyosi Coal. The new company incorporates several key Anglo Coal assets, namely the Kriel colliery and the Greenfield projects of Elders, Zondagsfontien, New Largo and Heidelberg.

### Exxaro

Exxaro is a South African-based, majority black-owned, mining group with a coal production capacity in 2008 of around 48 Mta. It has consolidated its position through mergers and acquisitions and in 2008 it produced a total of 45 Mtpa which included 36.3 Mt for Eskom and 3.3 Mt for export markets. It has an export entitlement at Richards Bay of 6.3 Mtpa.

Table 3: Exxaro Coal Mines in South Africa

Mine	Opencast U/ground	Coal field	Market	Capacity Mta
Arnot	U	Witbank	Eskom: Arnot	5
Matla	U	Witbank	Eskom: Matla	14
North Bank Complex	U	Witbank	Dom + export	3
New Clydesdale	U	Witbank	Export	1.4
Leeuwpán	O	Witbank	Eskom + metallurgical	3
Inyanda	O	Witbank	Export	1.5
Tshikondeni	U	Soutpansberg	Hard coking	0.4
Grootgeluk	O	Waterberg	Eskom: Matimba	15.3
Grootgeluk	O	Waterberg	Metallurgical	1.5
Grootgeluk	O	Waterberg	Semi-soft coking	2.7
Grootgeluk	O	Waterberg	Eskom: Medupi	(14.6) <sup>a</sup>
Mafube (50%)				
<b>TOTAL</b>				<b>47.8</b>

Source: Exxaro Website & Annual Report 2008; bracketed data represent future production

<sup>a</sup> Due to come online in 2012

<sup>11</sup> New Vaal coal for Eskom is amongst the lowest calorific value used in the country: 16 MJ/kg .

In addition to its mines in the Witbank field, Exxaro is currently the one large operator in the Waterberg, where different qualities of coal are found. Semi-soft coking coal is present in an upper 60m thick sequence of intercalated mudstone and coal bands (the Grootgeluk Formation) and steam coal is found in a lower 55m thick portion of discrete seams (the Vryheid Formation). This is high ash coal and requires washing before supply to Eskom's power plants (typically 60% down to 35% ash). Further washing would be required for exports. Mining utilizes the open pit truck and shovel method with bench heights ranging from 4 to 20 metres. The Grootgeluk mine (originally established by the state to supply product to Iscor's steel plants) has the world's largest coal beneficiation complex where 7600 tonnes per hour of run-of-mine coal is upgraded in six different plants. The yield of blend coking coal from the upper mining benches is only about 10%. The yield of middlings steam coal is around 40%.

Of Grootgeluk's production, some 15.3 Mtpa is now supplied on a long-term, low-priced contract to Eskom's 3990 MW Matimba power station via a 7km conveyor belt. Matimba is the largest dry-cooled power station in the world. An additional 1.5 Mtpa of metallurgical coal is sold domestically to Arcelor-Mittal's Saldanha Steel plant and the local smelting market. Grootgeluk also produces 2.7 Mtpa of semi-soft coking coal, the bulk of which is railed directly to Arcelor-Mittal's Vanderbyl steel plant under a long term supply agreement.<sup>12</sup> Approximately 1.1 Mtpa of semi-soft coking coal and thermal coal is exported through Maputo and Durban. Exarro has signed a 40 year coal contract to supply 14.6 Mtpa to Eskom's new coal fired plant, Medupi, from a R9 billion expansion of its Grootgeluk mine.

There are serious constraints on rail infrastructure out of the Waterberg. Exxaro would like to see rail capacity from the Waterberg increased to 40 Mtpa – with about 20 Mtpa for exports and 20 Mtpa for Eskom's Mpumalanga power plants.

### ***Sasol***

Sasol's coal-to-liquids and chemicals processes consume about 44 Mta of coal. This is supplied mainly by its subsidiary company, Sasol Mining (Pty) Ltd, now South Africa's third largest coal producer, after Anglo Coal and Exxaro, with production capacity of 43-46 Mtpa, although total production has been lower - about 39 Mt in 2009. The vast majority of Sasol Mining's coal production is from its mines in the Highveld coal field which supply its Secunda CTL and associated power plants. In addition, its Twistdraai mine, and the Igoda Coal subsidiary with Eyesizwe, also in the Highveld coalfield, supply export coal (up to 3.6 Mtpa). The production ratio at Twistdraai is roughly 40% export (washed) coal, 40% middlings for synfuels and 20% fine, discard coal. The new Thubelisha shaft in the north-east of the Secunda complex will replace the depleting Twistdraai operation. Another new mine—Impumulelo—is being established in the south-western portion of the Secunda complex to replace the Brandspruit mine. Sasol Mining's Sigma/Mooikraal mine at Sasolburg (the site of the original CTL plant) provides around 1.7 Mtpa for power generation at its

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<sup>12</sup> Iscor unbundled its mining assets into Kumba in 2001 and subsequently sold a majority shareholding in its steel plants to Mittal which became Acelor-Mittal in 2006

Infrachem facility. Sasol Mining also does some trading. It purchased about 5 Mtpa from Anglo's Isibonelo (in a reserve for market swop) and, in the past, has made some small sales to Eskom and other industries.

### ***BHP Billiton***

BHP Billiton is one of the world's largest producers and marketers of export thermal coal. It has coal mining operations in New Mexico in the USA, Australia and South Africa. It also has coal exporting interests in Colombia and Indonesia. BHP Billion Energy Coal South Africa (BECSA) is its largest coal operation, producing 45 Mt in 2008 from four collieries. In 2009, this figure dropped to 31.7 Mt after the sale of Optimum.<sup>13</sup> BHP Billiton used to be one of the largest coal producers in South Africa, but now ranks fourth after Anglo, Exxaro and Sasol.

*Table 4: BHP Coal Mines in South Africa (2008)*

Mine	Share	Opencast U/ground	Coal field	Market	2008 Mtpa
Middelburg	84	O	Witbank	Eskom Duvha & export	12.1
Douglas	84	O / U	Witbank		4.9
Khutala	100	U	Witbank	Eskom Kendal	13.3
Klipspruit	100	O	Witbank	Export	3.4
Optimum	sold	O	Witbank	Eskom Hendrina & export	11.3
<b>Total</b>					<b>45</b>

*Source: BHP Billiton Annual Report 2008*

BECSA's coal contract for Eskom's Duvha power station is a fixed price, guaranteed volume contract whereas with Kendal it is a cost plus arrangement. The Douglas mine is currently being closed. New projects include the 16 Mtpa Phola Coal Processing Plant in a 50:50 joint venture with Anglo Coal. The plant, processing 8 Mtpa of coal from each of the joint venture partners, will be located in the Klipspruit area and is being constructed by Anglo Coal. Another is the Douglas-Middelburg Optimisation (DMO) Project, with an expected capital investment of US \$975 million. BHP sold its Optimum Mine in 2008, along with a 6.5 Mtpa export entitlement at Richards Bay, in a black economic empowerment deal. BHP Billiton retains a 17.95 Mtpa export entitlement.

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<sup>13</sup> Optimum is the 6th largest thermal coal producer and 4th largest exporter of thermal coal in South Africa. The Optimum Coal operations include Optimum Collieries, a large opencast and underground mining complex comprised of four coal production areas with a reserve base in excess of 270m tons of run-of-mine coal as at 30 June 2009, of which 191m tons are classified as saleable. For the year ending 30 June 2009, Optimum Coal sold 9.3m tons of coal, of which 45% was exported. Optimum Coal also owns 6.86Mt of export entitlement at RBCT, of which 6.50Mt are for its own use. Optimum Coal also owns an effective 96% interest in Koornfontein Mines in Mpumalanga which has a reserve base of 46.5m tons of run-of-mine coal, of which 30.7m tons is classified as saleable. In addition, Koornfontein Mines owns a further 1.58Mt of export entitlement at RBCT, of which 1.50Mt are for its own use.



## Xstrata

Xstrata Coal is the world's largest producer and exporter of thermal coal and has operations in Australia, South Africa, Colombia and Canada. Xstrata's South African coal production in 2008 was around 20 Mt of which 12.3 Mt were exports.

*Table 5: Xstrata's South African Coal Mines*

Mine	Opencast U/ground	Coal field	Capacity Mtpa	2008 Mtpa
Southstock <sup>14</sup>	O	Witbank	.7	0.7
Southstock	U	Witbank	5	4.6
Mpumalanga: Spitzkop <sup>15</sup>	O/U	Ermelo	1.4	1.1
Mpumalanga: Tselentis	O/U	Ermelo	1.4	1.3
Impunzi <sup>16</sup>	O	Witbank	5.4	2.3
Impunzi	U	Witbank	0	1.1
Tweefontein <sup>17</sup>	O	Witbank	3.5	3.5
Tweefontein	U	Witbank	2.7	2.7
Goedgevonden <sup>18</sup>	O	Witbank	6	2.9
<b>TOTAL</b>			<b>26.1</b>	<b>20.2<sup>19</sup></b>

*Source: Xstrata Annual Report 2008*

Xstrata's Impunzu underground mine has now been closed, while the new Goedgevonden opencut thermal mine has been commissioned and is increasing production.

<sup>14</sup> The Southstock Division comprises the South Witbank, Middelburg, Douglas, and Tavistock collieries. Bituminous coal is mined at Southstock from the No 5, No 4 and No 2 coal seams using a combination of underground and opencast mining methods. The complex currently has two washing plants, both producing a high quality thermal coal for the export market and a lower quality secondary product for the local power utility. A new plant is under construction for the newly commissioned Southstock 5 seam opencast operation that will produce export thermal coal and inland metallurgical coal. All the operations in the Southstock complex are 100% owned by Xstrata South Africa, except for the Douglas and Middelburg mines which were operated under a joint venture with BHP Billiton Energy Coal South Africa (BECSA). In March 2008, Xstrata announced the restructuring of its Douglas Tavistock Joint Venture (DTJV) with BECSA. Under the terms of the restructuring, Xstrata acquired and now manages the mining of reserves approximately equivalent to its original 16% share in the DTJV, in an area contiguous to its 100% owned Arthur Taylor Colliery Open-Cast Mine (ATCOM) operations. Xstrata commenced separate mining operations from 1 July 2009 in a renamed operation ATCOM East.

<sup>15</sup> The Mpumalanga Complex consists of Spitzkop and Tselentis Collieries situated South and North of Breyten respectively. Breyten is approximately 100km south of Middelburg and 35 km north of Ermelo. Each mine has opencast and underground sections. Coal is mined underground by a continuous miner. Truck and shovel mining for all the opencast sections is done by contractors. About 80% of the coal produced at Spitzkop is exported to Europe for power generation and the balance is sold on the inland market - mainly to sugar and paper mills in Swaziland and the North Coast of Kwazulu Natal. Tselentis Colliery's product is mostly exported.

<sup>16</sup> The iMpunzi Mining Complex is a large export bituminous coal mining operation located 110 km east of Johannesburg and 27 km south of the town of Witbank. iMpunzi is the Zulu word for the Duiker antelope. The complex consists of 2 underground mines, Phoenix Colliery and Arthur Taylor Colliery (ATC), and an opencast mine ATCOM (Arthur Taylor Colliery Opencast Mine). Since 1 January 2007 the iMpunzi Mining Complex has been 100% owned by Xstrata Coal. In addition to exports, the Phoenix Colliery produces also for local power stations.

<sup>17</sup> Tweefontein is 100% owned by Xstrata Coal SA and consists of three mines – the Boschmans, Waterpan and Witcons Collieries—which have been structured into open pit, underground and surface operations. The Tweefontein Complex is located 110km north east of Johannesburg and South of the town of Witbank close to the town of Ogies in the Mpumalanga Highveld. Mining operations are currently carried out on the 4 and 2 seam horizons. Coal is sourced from both opencast and underground areas with a 35:65 split. Contractor mining is used on opencast coal. All underground coal is mined with Continuous Miners. The mine produces exports through Richards Bay Coal Terminal as well as domestic sales and smaller amounts to Eskom.

<sup>18</sup> Goedgevonden Colliery (GGV) is situated 7km south of Ogies, a small town to the west of Witbank. GGV is jointly owned by ARM Coal (51%) and Xstrata SA (49%). ARM Coal is in turn held by both African Rainbow Minerals (51%) and Xstrata South Africa (49%) – meaning that Xstrata has an effective interest of 74% in Goedgevonden (Xstrata Annual Report, 2008).

<sup>19</sup> In the text of Xstrata's 2008 Annual Report, South African coal production is recorded as 24 Mt. ARM reports total coal production in 2008 of 25.3 Mt.

Black empowerment company African Rainbow Minerals (ARM) has a 10% direct interest in Xstrata Coal South Africa (XCSA). ARM also owns 51% of its subsidiary, RM Coal, which in turn holds a 20% interest in XCSA.<sup>20</sup> ARM's overall economic interest in XCSA thus amounts to 20.2%.<sup>21</sup>

Xstrata Coal plans to invest US \$2 billion to develop four local projects in the next five years, including the Goedgevonden expansion (6.8 Mt + 4.5 Mt), optimisation of Tweefontien & Atcom East (2 Mt) and a new mine, Zonnebloem (7-12 Mt).

Xstrata Coal South Africa holds a 20.9% interest in the Richards Bay Coal Terminal Company Ltd (RBCT).

## 4.2 Major domestic coal consumers

In this section we explore in more detail the structure and dynamics of local coal demand, primarily for Eskom's power stations and Sasol's CTL plants.

### *Eskom*

#### *Eskom's coal-fired power stations and coal contracts*

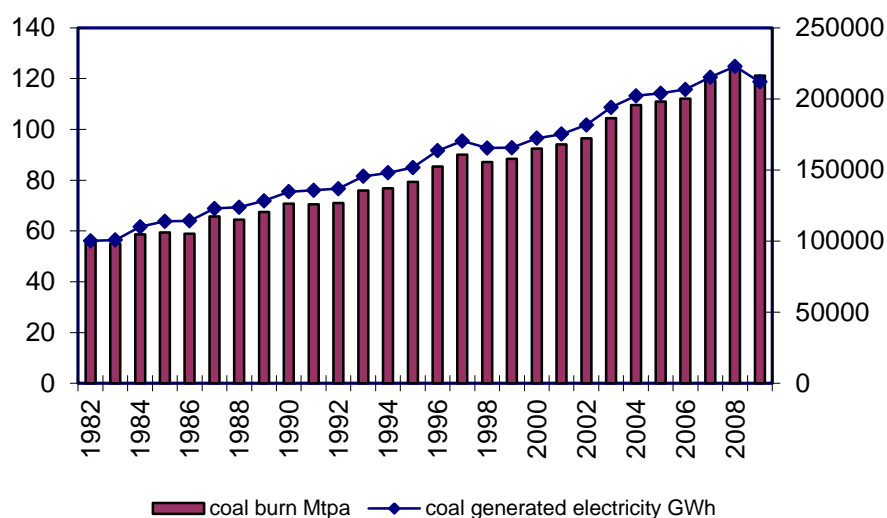
South Africa's power industry is dominated by the state-owned national utility Eskom, which generates 96% of the country's electricity. Its electricity prices are regulated by the National Energy Regulator of South Africa. In 2009, Eskom's total generating capacity was 40,870 MW of which 34,658 MW were coal-fired power stations. In 2009, Eskom generated 233 TWh of electricity of which 216 TWh was produced by coal-fired stations. It burnt 123 Mt of coal amounting to about 70% of the total used in South Africa (Eskom 2010).

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<sup>20</sup> The other 49% is held by Xstrata.

<sup>21</sup> XCSA is also referred to by ARM as its Participating Coal Business (PCB). ARM also has a 26% interest in Xstrata's Goedgevonden colliery. ARM Coal has access to Xstrata's 20.9% interest and entitlement in the Richards Bay Coal Terminal (RBCT) and an export entitlement of 3.2 Mtpa in the Phase V expansion of the terminal ([www.arm.co.za](http://www.arm.co.za)).

Figure 6: Coal generated electricity (TWh – right axis) and coal burned (Mtpa – left axis), Eskom, South Africa



Source: Eskom Annual Reports

Table 6: Eskom’s Coal-fired Power Stations: 2009

Power station	Location	MW	Principal Coal supplier
Arnot	Middelburg	2040	Exxaro
Camden	Ermelo	1440	
Duvha	Witbank	3450	BHP Billiton
Grootvlei	Balfour	760 (1200)	
Hendrina	Hendrina	1895	BHP Billiton
Kendal	Witbank	3840	BHP Billiton
Komati	Middelburg	(1000)	
Kriel	Bethal	2850	Anglo Coal
Lethabo	Sasolburg	3558	Anglo Coal
Majuba	Volksrust	3843	
Matimba	Lephalale	3690	Exxaro
Matla	Bethal	3450	Exxaro
Tutuka	Standerton	3510	Anglo Coal

Source: Eskom Annual Report 2010

(Bracketed data reflects mothballed capacity being returned to service)

Eskom’s coal-fired power stations use conventional pulverised coal technology, with average thermal efficiencies of 33%. Coal quality is poor with average calorific values of 4500 kcal/kg (19 MJ/kg), ash 29.5%, and sulphur 0.8% (Eskom 2010 Annual Report). Coal quality has been deteriorating in recent years as coal suppliers reserve higher grades for more lucrative export markets.<sup>22</sup> Electrostatic precipitators are employed to reduce particulate emissions but none of the power stations have flue-gas desulphurisation. Eskom currently emits 225 Mt of CO<sub>2</sub> per annum.

Eskom’s coal-fired power stations are mine-mouth, mostly supplied by conveyor belts. Nine of these stations have long-term coal contracts: six of these are “cost-plus” and three are “fixed price”. In the cost-plus contracts, Eskom and the coal supplier jointly provided capital

<sup>22</sup> Eskom claims that poor coal quality has resulted in load losses of close to 40% in its Duvha and Matla power stations. The Arnot power station has also had problems with poor coal qualities.

for the establishment of the colliery. Eskom pays all the costs of operation of the colliery and the supplier is paid a net income by Eskom on the basis of a return on the capital invested (ROI) by the coal supplier in the colliery. The ROI is divided into two components. The fixed portion is a set ROI, payable irrespective of coal production and the variable portion is based upon tonnages supplied to Eskom. The ROI is generally escalated for half of the duration of the contract and is typically between 15% and 25%. In the fixed price contract, coal is supplied at a predetermined price, i.e. a base price which is escalated by means of an agreed formula. There are no early termination provisions in the contracts. Cost-plus contracts have no real incentives for cost minimisation. Future contracts are likely to be all fixed (indexed) priced.

In the past, nearly all of Eskom's coal was supplied on long term contracts. However, Eskom is now also exposed to short or medium term contracts which account for about a quarter of its coal supply. Small coal contractors, supplying via road transport, are an increasing phenomenon. In part this is due to Eskom's power stations being run at capacity factors higher than those envisaged in the long term supply contracts. A further driver has been Eskom's commitment to increase its procurement expenditure with black-owned firms, as part of government's overall black-economic empowerment drive. The growth in short term contracting was also spurred by the fact that the coal mines that were originally developed for two of Eskom power stations, Majuba and Tutuka, were unable to meet production expectations and these are now also supplied mainly by road and, in the case of Majuba, partially by rail. Increased dependency on road transport has seriously impacted road infrastructure and Eskom has had to invest directly in road repairs. A feasibility study for a larger capacity railway line from Ermelo to Amersfoort for the Majuba power station was undertaken in the 1990s but was never acted upon; similarly a railway connection to Tutuka power station was never built. The return to service of Eskom's old Camden, Grootvlei and Komati power stations will also mean more road haulage of coal.

The average price Eskom pays for coal has increased quite substantially as its reliance on short term contracts has increased. Nevertheless, Eskom's average coal costs are still very low compared to international prices. Average coal prices in 2008, according to data from the Department of Mineral Resources, were around R112/tonne. However, further analysis indicates that this figure is probably too low. Eskom's Annual Report (2009) shows that its generation primary energy costs were around R23.1bn (US \$3bn). Some of this was for diesel for its open-cycle turbines and for nuclear fuel, but the majority was for coal purchases (132.7 Mt), implying an average coal price of less than R170 /tonne. Eskom's Annual Report (2010) indicates that R26.8 bn had been spent on generation primary energy (including coal and nuclear fuel rods) and that 121.8 Mt of coal was purchased, implying an average coal price of less than R200 / tonne (US \$27/tonne).

### *Eskom's performance*

In recent years, Eskom has not been able to meet fully the demand for electricity in South Africa and there have been a number of blackouts. In the period 1999-2004, the government was considering unbundling Eskom and introducing a competitive electricity market. Private investment in generation was encouraged, and Eskom was prohibited from building new power stations. The reforms were part of a wider effort to improve efficiencies in state-owned enterprises and the overall competitiveness of the economy. However, by 2004 the design of the new market had not yet been approved (partly because of insufficient political buy-in and union resistance, and partly because of tacit resistance by Eskom). Contracting arrangements for Independent Power Producers been not been put in place. With no new private investment, government backtracked on its market reforms and once again charged Eskom with responsibility for generation expansion planning and new investments (although it is still government policy that independent power producers (IPPs) may provide up to 30% of electricity generation).

The consequence of this policy detour was Eskom falling four years behind in terms of power station investments. Growing demand soon out-stripped supply and blackouts began to be experienced from 2006, first in the Western Cape, and then later nationally. The situation was exacerbated by poor operating performance of Eskom's existing plant and the run-down of its coal stockpiles, in part because of higher burn rates, un-seasonal rain and supply problems, but also because Eskom's financial managers were pushing for lower inventory costs. In January 2008, Eskom load-shed large energy users such as mines and minerals beneficiation industries in order to avert a total system collapse. Although, these users resumed operations a week later, they were subjected to electricity consumption quotas which lasted until late 2008 when demand fell away as the global recession impacted the South African economy.

A memo prepared by Wingfield consultant Susan Olsen for Eskom, and subsequently leaked to the press, paints a damning picture of Eskom's coal contracting in the period leading up to the blackouts. She questions why Eskom failed to secure long term contracts for the Camden and Majuba power stations in the seven years after Ingwe was released from its obligations. She questions further why existing long-term contracts at the other power stations were not renegotiated to meet higher burn requirements<sup>23</sup> and Eskom's failure to enforce even minimum performance in the existing contracts. As export prices escalated, some of the tied collieries (such as Optimum, Grootgeluk and Douglas/Middleburg) focused on meeting export qualities and tonnages at the expense of quality and tonnage for Eskom. Apart from Majuba, coal supply problems have been most acute at Tutuka's new Denmark colliery which is incapable of producing at its contractual level. Olsen concluded: "[Eskom's] Generation Primary Energy (GPE) division as it is structured and managed cannot meet current needs much less future requirements. GPE lacks leadership, knowledge and direction. It is haemorrhaging staff and is left with those who have delivered it to its current condition"(Olsen, 2007).

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<sup>23</sup> Kendal's Khutala Colliery could actually produce beyond its contractual ceiling but Eskom failed to follow through with negotiations to set a price for such incremental tonnage.

Eskom's CEO failed to act on these warnings and the 2008 blackouts ensued, induced in the end by insufficient coal for Eskom's power stations. Ultimately, Eskom's CEO was sacked and a new executive team is seeking to restore supply security. Coal stockpiles were rebuilt to an average of about 42 days (although recently these have declined to about 36 days). The level of coal stockpiles differ from power station to power station: Matimba, which is supplied reliably by an adjacent mine, has a stockpile of around 20 days; the more vulnerable Majuba station has a stockpile of about 75 days.

However, supply and quality problems remain. Only three of Eskom's power stations, Kriel, Matla and Matimba are currently supplied entirely by conveyor systems from adjacent mines. Conveyor supplies to the Lethabo, Hendrina, Kendal, Duvha, Tutuka and Arnot power stations have to be supplemented by road deliveries of coal. The Camden power station is entirely supplied by road and, as previously mentioned, Majuba is supplied by both road and rail. The World Bank loan to Eskom, announced in 2010, includes funding for the development of a heavy haul coal line to Majuba. Deteriorating coal quality at Duvha, Matla and Tutuka, in particular, have led to these power stations operating well below their rated capacity resulting in annual losses of about R1 billion.

#### *New investment*

The electricity supply/demand situation remains tight and Eskom is now playing catch-up. It has embarked on a massive investment programme which will see its capacity increased by about 12000MW over the next 10 years. The planned capex programme over the next five years amounts to close to R400 billion (US \$53 billion).

Much of Eskom's new generation capacity will be coal-fired. It has brought back into service three old coal stations (Camden, Grootvlei and Komati) and is currently constructing two new coal fired power stations: the 4764MW Medupi<sup>24</sup> plant in the Waterberg (to be supplied by Exxaro) and the 4800MW Kusile plant in the Witbank coalfield (to be supplied mainly by Anglo Coal's New Largo colliery). These new power stations will use supercritical technology. Medupi, situated in the remote Waterberg coalfield, will not initially have flue-gas desulphurisation (FGD), while Kusile, located in the more densely settled Mpumalanga Province, will have FGD fitted upfront. Both will evidently be "carbon-capture ready" – i.e. they could be retrofitted with this technology at a later stage.

Investment decisions have not yet been made beyond the Kusile plant. Earlier plans envisaged the construction of two further mega coal power stations by Eskom but, as we shall see later, environmental concerns now make this unlikely. Quotes for a new nuclear power station turned out to be very expensive and beyond Eskom's means to finance from its balance sheet. South Africa has insufficient natural gas and hydro capacity and other renewable energy resources, such as wind, have not yet been exploited on a large scale.

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<sup>24</sup> The World Bank agreed in 2010 to provide US 3.75 billion to help finance this coal plant despite objections from some of its shareholders and NGOs that this was contrary to its commitment to promote more sustainable energy paths.

In addition to Eskom's coal power stations, it is possible that some coal-fired Independent Power producers (IPPs) could enter the market. Eskom commenced a competitive bid process—the multi-site baseload IPP programme—although there are still a number of uncertainties around the contracting process and whether, or when, these investments might materialise.

### ***Sasol***

Sasol operates the only commercial coal-to-liquids fuel production facilities in the world. Its Secunda plants produce around 160,000 barrels per day of petroleum (just over a quarter of South African consumption) as well as a range of petro-chemical products. It is also one of the largest single sources of carbon emissions in the world. It consumes around 44 Mtpa of high ash (35%) and low calorific value (less than 5000 kcal/kg) coal, amounting to about a fifth of domestic coal use. Sasol's total greenhouse gas emissions total 72.7 Mt CO<sub>2</sub> equivalent per annum.<sup>25</sup> While synfuel production at Sasol's existing Secunda plant will increase by up to 20% by 2015, it will not require much additional coal production; additional feedstock will be natural gas from Mozambique and coal fines from stockpiles.

Sasol is currently undertaking a pre-feasibility study for a new US \$5-7 billion, 80,000 barrels per day, CTL plant called Mafutha in the Waterberg coal field. It has signed a joint venture agreement with Exxaro to explore the feasibility of a coal mine which would supply 25 Mtpa to the new Sasol plant. While Sasol staff are optimistic regarding the viability of this investment, government departments are more cautious, both in terms of the tax and fiscal support measures being sought by Sasol and also the impact Mafutha will have on South Africa's greenhouse gas emissions.

As previously mentioned, Sasol's coal is supplied almost entirely by its subsidiary, Sasol Mining from adjacent mines, through an internal transfer price which is not publicly disclosed. According to Sasol's 2008 annual report, Sasol Mining earned R5 billion from "inter-segment" turnover which would imply a price of less than R120/tonne (US\$15/tonne). DMR data for 2008 indicates an average price of R127/tonne for coal for synfuels production. Data derived from Sasol's 2009 Annual report indicate that internal coal prices for its synfuel operations are less than R150/tonne (US\$20/tonne). Sasol Mining also exports small amounts of high value coal which contribute about a third of its coal revenue.

### ***Industry and residential coal consumption***

Small merchants trade around 2% of domestic coal consumption, mostly to small businesses and households. About one million tonnes is sold into a retail market for domestic space heating during the cold winters of the interior, generating high levels of particulate air pollution. Larger industries, including cement and chemicals, consume a further 8 Mtpa. Finally, metallurgical coal accounts for about 5.4 Mtpa.

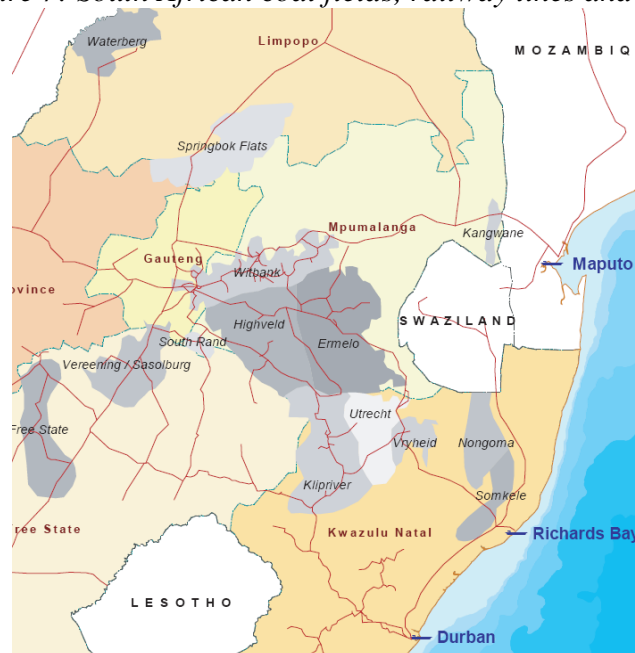
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<sup>25</sup> From synfuels as well as production of chemicals.

### 4.3 Coal rail infrastructure

A major current constraint in moving coal to markets, particularly export markets, is South Africa's aging and inefficient rail infrastructure. Nearly all of South Africa's export coal is transported via rail from the central coal basin to Richards Bay on the East Coast. The national state-owned rail monopoly, Transnet, owns and operates a dedicated coal track from Witbank to the sea, a distance of 580km. The double line is bi-directionally signalled and fully electrified. Two 100-wagon trains are coupled to form one 200-wagon train at Ermelo, in Mpumalanga, typically using CCL-type wagons. There are approximately 28, 200-wagon set trains in operation on the coal line at any given day.

Figure 7: South African coal fields, railway lines and ports



A ten-year contract between Transnet Freight Rail (formerly called Spoornet) and the coal mining companies came to an end in 2004/5, and new fixed contracts are still being negotiated. Some of the pricing elements in the contracts are the distance to the Richards Bay Terminal and time taken to load wagons. This means that if a coal-mining company invested in efficient loading facilities and could load wagons quicker, a lower tariff would be paid. The average time to load a 100-wagon train is about 4.6 hours. With efficient loading facilities, such as those found at BHP Billiton's Douglas colliery in Mpumalanga, a 100-wagon train could be loaded in 2.3 hours. Smaller coal miners generally have longer loading times.

The Waterberg field is 1050km from the coast and does not yet have a dedicated coal rail link to Richards Bay. Currently, small amounts (less than 1 Mtpa) are railed from the Waterberg via the existing Transnet Freight Rail network.



There is an apparent lack of planning and investment coordination between Transnet, coal producers and ports. While port capacity at Richards Bay has increased, coal exports have actually decreased in recent years. Rail capacity needed to increase to 76 Mtpa by 2008 and 91 Mtpa by 2010 to match expansions at the Richards Bay Coal Terminal; however, current rail capacity remains below 68 Mtpa, and actual performance has been even lower with some costly derailments. Shortages of locomotives, wagons and skills are also cited as problems. Transnet counters that coal train schedules have outpaced the availability of coal from the mines.<sup>26</sup> Only 61 Mt were railed to Richards Bay in 2008 and a similar amount in 2009.

Transnet's tardy response to possible growth in coal markets (especially for export) needs to be seen within the context of its overall business. Top-line income from Transnet's rail freight business (of which its dedicated export coal line to Richards Bay contributes a quarter) accounts for more than half of its total annual revenue. But profit margins from rail are small. Transnet's other businesses, namely its ownership and operation of South Africa's ports (other than Richards Bay), and petroleum pipelines, account for the lion's share of its profits. Historically, its general rail freight business has generated insufficient income for reinvesting in much needed infrastructure upgrades. For example, in 2009 rail contributed R241m to its profits, pipelines R590m and ports R5262m (Transnet, 2010).<sup>27</sup> Transnet is probably the only integrated rail-ports-pipeline state-owned monopoly in the world. Its port and pipeline operations currently subsidise its rail operations. This situation may not survive as pressure builds for more effective regulation of the sector and for port and pipeline operations to be providing more competitively priced and better quality services to customers.

Transnet is undertaking feasibility studies on expanding the coal link to Richards Bay, initially to 81 Mtpa by 2014/5 and thereafter to 91 Mtpa. It estimates that about R40 billion (US\$5 bn) would need to be spent over a decade to accomplish this, including investment in additional rolling stock, new bridges and tunnels and more double-track.<sup>28</sup> It appears unwilling to embark on this upgrade without long term guaranteed usage agreements with coal exporters. Currently, none of the agreements are longer than a year.<sup>29</sup> Transnet's current approved five year investment programme for the Richards Bay coal line amounts to R8.8.bn (US\$1.1 bn), including the purchase of 110 new locomotives and capacity expansion to 71 Mtpa (Transnet, 2010). In October 2010 Transnet announced that it is willing to commit R15.4 bn (about US\$2 bn) to expanding capacity to 81 Mtpa, provided long-term take or pay contracts are signed with coal exporters. New draft contracts have been drawn up with the intention of reaching agreement in 2011.

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<sup>26</sup> Estimates of exportable reserves by some of the new, smaller coal miners were initially overstated – leading to some scepticism by Transnet of actual coal that could be transported.

<sup>27</sup> Historically, the coal and iron ore lines were run as profitable, separate business divisions – but these were reintegrated into Transnet's General Freight business, obscuring many of the problems, and making it harder to ring-fence revenue for reinvestment into the dedicated commodity lines.

<sup>28</sup> The 7 km Overvaal tunnel will need to be widened to accommodate a twin track.

<sup>29</sup> The last long-term contract expired in 2005. Since then coal exporters have been haggling over rail tariffs. Transnet has been looking for take-or-pay contracts to underwrite its investment in expanding rail capacity. However, many of the new small coal companies do not have the balance sheets to take on this commitment.

Transnet has not yet made a decision on building a new rail line from the Waterberg through to Witbank.

While Transnet is a wholly owned state-owned enterprise, with a Board appointed by the Minister of Public Enterprises, it is fully corporatised and subject to the Companies Act. In the absence of strong policy directives from either the Minister of Public Enterprises or the Minister of Transport, the Board and management have appeared to be more focused on turning around Transnet Freight Rail's poor financial performance and less attention has been given to long-term national strategic investment choices. This was especially the case during the recent tenure of a strong-minded Chief Executive who was previously the Director-General of the National Treasury.

There remains a high degree of dissatisfaction by private coal miners and exporters with the rail bottlenecks. Derailments are not uncommon, blocking the line and reducing export potential. Alternative business models have been proposed by coal mining companies, including possible private ownership and operation of rolling stock. However, these options are dependent on government agreeing to a new policy on public-private partnerships in the rail sector, and more purposeful directives to the Board of Transnet.<sup>30</sup>

#### **4.4 Coal ports and exports**

As mentioned previously, the Richards Bay Coal Terminal was opened in 1976 with an export capacity of 12 Mtpa. A phase 2 expansion doubled capacity to 24 Mtpa in 1979. Phase 3 in 1984 increased capacity to 44 Mtpa.<sup>31</sup> Further upgrades increased capacity to 63 Mtpa in 1991, 72 Mtpa in 1999 and 76 Mtpa in 2008. The phase 5 expansion in 2010, at a cost of R1.2 billion (US\$150m), has taken capacity to 91 Mtpa. Feasibility studies are being done to increase RBCT's capacity to 105 Mtpa in five years, although this next phase is likely to be delayed until rail capacity catches up. RBCT is the largest single coal terminal in the world.

Coal exports through Richards Bay have declined for the past four years, mainly because of the rail constraints mentioned above. RBCT coal exports peaked at 69.2 Mt in 2005 but declined to 61 Mt in 2008, implying 30% of the port's new export capacity could remain unused. South Africa's global ranking as a coal exporter has declined. In 2000 it was second behind Australia, but by 2002, Indonesia had overtaken South Africa and by 2004, Russia, and by 2008, Columbia, also.

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<sup>30</sup> The 2006 Freight Logistics Strategy issued by the Department of Transport recommended clarity of roles between SOEs and the private sector and the creation of space for private sector involvement in funding and operation of infrastructure. Remote branch rail lines are being concessioned, however, there appears to be political resistance to further private sector participation and the new Public Enterprises Minister (appointed in late 2010) has stated clearly that State-Owned Enterprises should play a lead economic and development role.

<sup>31</sup> A third of these export allocations were granted to Shell, BP and Total, motivated by a strategic objective of securing ongoing investment and involvement by oil multinationals at a time of international oil sanctions against the apartheid state. Shell entered into a 50:50 joint venture with Rand Mines. BP also collaborated with Rand Mines in its Middleburg Colliery and Gencor entered into a joint venture with BP and Total to develop the Ermelo colliery. JCI also collaborated with Total.

Figure 8: Richards Bay Coal Terminal Capacity (Mtpa)

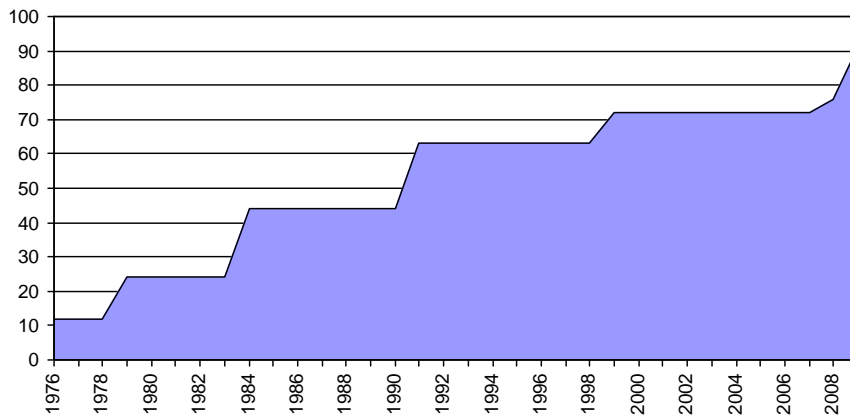
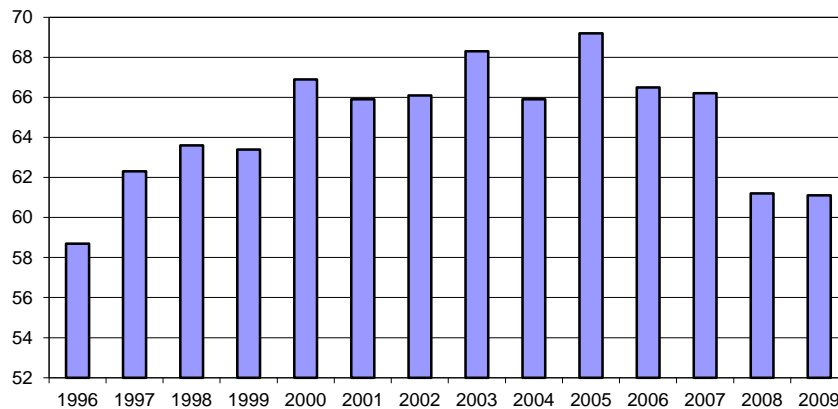


Figure 9: Coal exports through RBCT (Mtpa)



Source: RBCT website and presentations

Until recently, Anglo, BHP and Xstrata were the major shareholders in RBCT with export allocations of 19.8, 17.95 and 15.05 Mtpa respectively, accounting for three-quarters of the terminal’s capacity. The balance of the export allocations were held by Optimum, Total, Sasol, Kangra, Siyanda, Exxaro and Eyesizwe (now part of Exxaro).

RBCT have been proactive in expanding the terminal despite rail constraints. They commissioned a market survey which indicated that an additional 40 Mtpa of export coal was potentially available. The additional 19 Mtpa which became available with the expansion of RBCT from 72 to 91 Mtpa were allocated as follows:

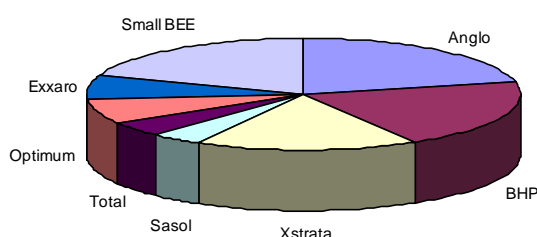
- 4 Mtpa (through the Quattro expansion) were allocated to emerging BEE exporters, typically with annual export volumes below 250,000 tonnes per annum. These volumes are made available on a commercial basis and do not come with entitlements to shareholdings in RBCT. The Department of Minerals and Energy–led Coal Industry Task Team (CITT) allocated the Quattro export entitlement to 18 BEE emerging companies for a minimum three-year period to facilitate mine development plans, structured financing and the development of long-term relationships with international customers. At the end of each year the past performance is reviewed and

the next three-year period considered. Umhlathuze Coal co-ordinates and facilitates the exports of the Quattro Common Users.

- 6 Mtpa to the South Dunes Coal Terminal Consortium<sup>32</sup> which represents a number of BEE exporters in a single company, including Kumba (now part of Exxaro), Eskom and Goland Coal.<sup>33</sup>
- The remaining 9 Mtpa was available (through tender) to larger exporters in excess of the 250 000 tonnes per annum, including those exporters who wanted a shareholding in RBCT or could sign long term contracts. The tender was oversubscribed and allocations were made on a ranking basis. BEE exporters were given priority and bidders also had to demonstrate export quality coal reserves and capacity support from Transnet Freight Rail.

The current shareholding and export allocations are summarised in Figure 10. Black-owned coal companies<sup>34</sup> now have about a third of export allocations, more or less in proportion to their overall contribution to coal production. In 2004, less than 1% of the terminal was owned by black-controlled companies.

*Figure 10 : Richards Bay Coal Terminal Export Allocations*



*Source: RBCT website and presentations*

Rail constraints mean that it will be some time before the full 91 Mtpa export allocation can be transported to the port. RBCT still has to announce how the export allocations will be realized over the next few years while rail constraints persist. It is possible that export allocations will be cut proportionally according to shareholding and Transnet's rail capacity, with the possibility of individual shareholders being able to expand their exports if others are not able to fulfil their allocations.

<sup>32</sup> The South Dunes Coal Terminal began as a determined effort to build a new and separate terminal at Richards Bay but evolved into a consortium whose tonnage requirement was accommodated within the RBCT expansion plans.

<sup>33</sup> Eskom has a 3 Mtpa export allocation but no coal fields. It is likely to lease its allocation to junior miners. Glencore has made an offer to supply discount coal to Eskom in exchange for its export allocation.

<sup>34</sup> Black-owned companies include Exarro, Mbokondo, Umcebe, South African Coal Mining Holdings, Worldwide Coal Carolina, Mmakau, Arm Coal, Tumelo and the South Dunes Coal Terminal Consortium.

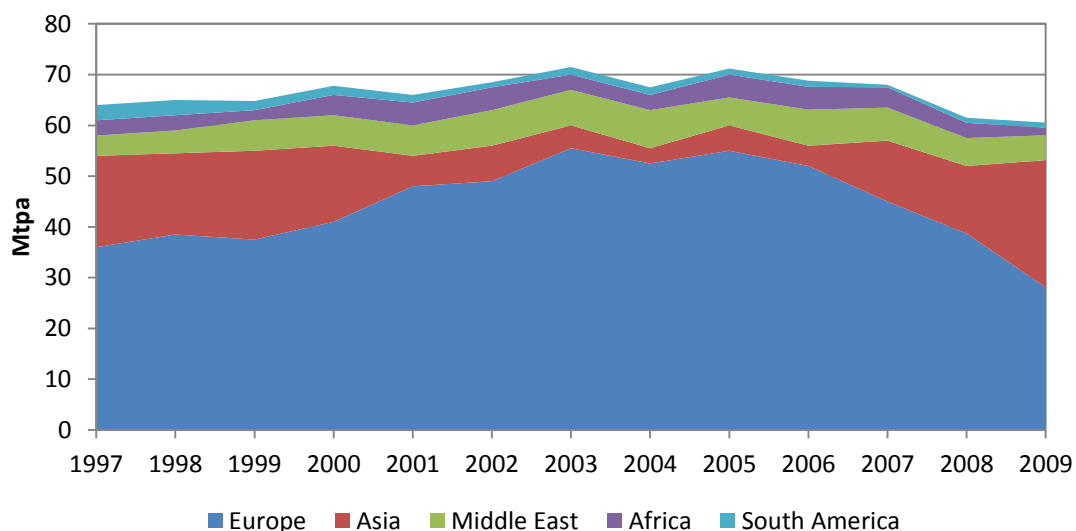
Small amounts of coal are also exported via the Richards Bay dry bulk and multi-purpose terminals (3Mta) as well as via Durban (900ta) and Maputo’s Matola port (1.1 Mtpa). Due to environmental constraints, coal exports via Durban may have to be shifted to Richards Bay. Grindrod Freight Services, which operates the Maputo Port concession, as well as the coal terminal sub-concession, is exploring plans to expand capacity to between 16 and 25 Mtpa by 2013. However, these will only be meaningful if rail capacity is expanded concomitantly. In the meantime 30 Mtpa of export capacity remains unused at Richards Bay.

#### 4.5 Coal export destinations

South Africa’s coal exports go to Europe (including Belgium, Denmark, France, Germany, Italy, Netherlands, Portugal, Spain, Switzerland and the United Kingdom), the East (mainly India but also to China, South Korea, Malaysia, Pakistan and Taiwan), the Middle East (Israel, Turkey, United Arab Emirates), Africa (mainly Morocco but also Kenya, Mauritius, Reunion and Senegal) and small amounts to Latin America (Argentina, Brazil, Chile and Mexico).

McCloskey coal consultancy forecasts indicate that demand for coal imports in Europe will slowly decline but that import demand in India and China and the Pacific basin will increase substantially. This swing to the east is already evident in South Africa’s coal exports: sales of coal to India have increased in recent years while sales to Europe have fallen, from about three-quarters of South African exports in 2005 to less than a half in 2009.

Figure 11: Destination of South African coal exports (1997-2009)



Source: Constructed from data from Marquard (2007) and Prevost (2010)

South Africa is effectively a swing producer between the Atlantic and Pacific coal markets. South Africa’s main competitors for European markets are Russia and Colombia. In the

Pacific coal market, Australia and Indonesia are the main exporters to China, India, Japan, Korea and other South East Asian countries, although South African coals are increasingly competitive in India and other Eastern countries. Even Columbian coal has found its way to the East.

#### **4.6 Coal costs and prices**

Although coal mining productivity in South Africa is comparatively poor compared with other world exporters (6500 tonnes/man-year on average, or 3700 tonnes/man-year if outside contractors are included), the costs per tonne are relatively low, mainly due to low wages. However, per capita wages in the sector have been increasing while employment has declined from around 123,000 in 1980 to around 37,800 (or 65,400 including outside contractors) in 2008 (Baruya, 2007; Prevost, 2009).

Export coals are washed or beneficiated to reduce ash content. All costs up to the washing stage obviously have to be divided by the washing yield (typically around 60%, but lower in the Waterberg) to determine the actual costs of transported or exported coal. South African coal generally has a good reputation on the market because washing guarantees a homogenous product. Quality control at RBCT is also tight. Two major coal qualities are generally used by traders (which differ mainly in their volatile matter: RB1 = min 22% as received volatiles and RB2 = min 25% as received volatiles). However, most mining companies have a number of coal brands and a typical physical coal contract may have up to 20 quality elements.

There is evidence that the quality of export coal is declining and an increasing volume of coal with a calorific value of below 6000 kcal/kg, on a net as received basis, is being marketed. This has implications for the supply mix, and in turn customer mix for South African producers. The lower the calorific value the harder it becomes to service distant destinations as the cost per unit of energy rises, when full delivered cost is taken into account. Nevertheless, there is growing demand for coals with calorific values ranging down to 5,500 kcal/kg for destinations such as India. These developments have led to calls for an additional trading category (RB3) for lower-grade export coal.

Domestic coal costs are obviously much lower than FOB export costs, with shorter transport distances and without the added costs of beneficiation /washing. The new, smaller miners tend to be higher cost producers while the larger coal majors benefit from economies of scale and better efficiencies. The long term trend in costs is upwards as labour costs increase, smaller mining operations multiply, lower quality deposits are mined and the development of the more remote Waterberg field accelerates.

The South African Department of Mineral Resources collates data on coal production and average *prices* and these are shown in Table 7 below. Average domestic coal prices were around R170/tonne (US\$ 23/tonne) in 2009. Export prices were about three times domestic prices on a mass basis (down from a multiple of about 5 in 2008). A further correction would

need to be made for differentials in calorific value: 27 MJ/kg for exports versus 19 MJ/kg for domestic power.

*Table 7: South African coal production and local and export sales 2009*

Commodity	Production Mass (Mt)	Local Sales			Export sales		
		Mass (Mt)	Value (R m)	Price R/t	Mass (Mt)	Value (R m)	Price R/t
COAL	249.7	171.1	29 606	173	61.1	31 118	509
ANTHRACITE (TOTAL)	1.6	0.7	498	710	0.4	368	836
BITUMINOUS (TOTAL)	248.1	170.4	29 108	171	60.7	30 712	506
BITUMINOUS STEAM	247.7	168.6	27 482	163	60.5	30 465	504
BITUMINOUS COKING	0.4	1.8	1 625	871			

*Source: DMR/Prevost, 2010*

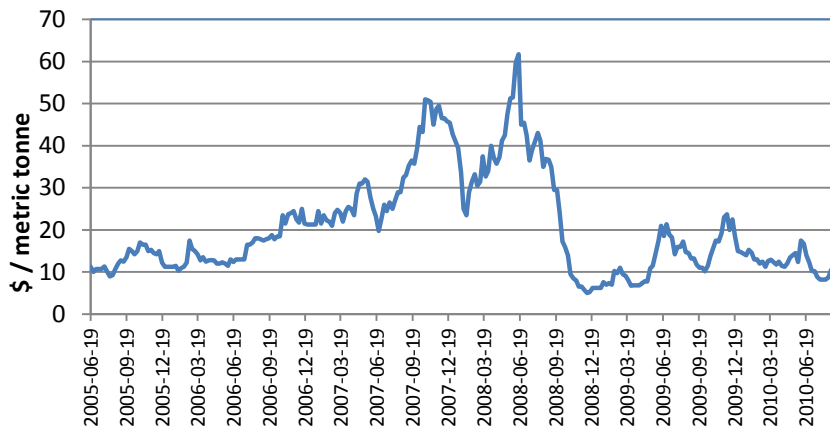
*(Production data is similar to IEA but the latter estimates SA 2009 exports higher at 66.9 Mt, the difference due in part to additional exports through Durban and Matola)*

Estimates made in 2007 of FOB costs for South African coal ranged from 27-48 US\$/tonne. Ex-mine, washed costs account for about two-thirds, inland transport around a quarter and port charges about 10% (Baruya, 2007; Schernikau, 2009). Mining costs increased substantially in 2007/8, in part because of the boom in commodity prices, and although prices of iron and steel and other commodities have since fallen, mining costs are still above 2006 levels. Rail freight charges on the Witbank-Richards Bay line were estimated in 2007 to lie between US\$ 6/tonne for large producers and US\$ 11/tonne for smaller producers (who often have additional truck haulage costs to link with the railway). Transnet's Annual Report (2009) indicates that average coal freight charges are around US\$ 9 per tonne or 1.5 US cents per tonne kilometre.<sup>35</sup> Richards Bay port charges are relatively low and have been estimated to be between US\$ 1.5-3.5/tonne (Baruya, 2007). RBCT reports that average user charges in 2008 were slightly over US\$ 3 per tonne.

Sea borne freight is a key CIF price (delivered price) determinant for coal. Standard routes to Europe typically use capesize (120-200 kt of bulk product) or panamax vessels (60-80 kt). Indian cargoes and other less standard routes often use handy-size vessels (20-45 kt). Historical sea freight charges are shown below for capesize vessels from Richards Bay to Europe (ARA). Charges peaked at US\$ 60/tonne in June 2008 before tracking back to US\$ 8/tonne in October 2008 and then fluctuating between US\$10-20/tonne since.

<sup>35</sup> Transnet Freight Rail earned R18.68 bn in 2008/9 of which 23.2% was from coal freight. 61.9 tonnes were transported over this period at an average distance of 573 km.

Figure 12: Capesize sea freight Richards Bay to Europe

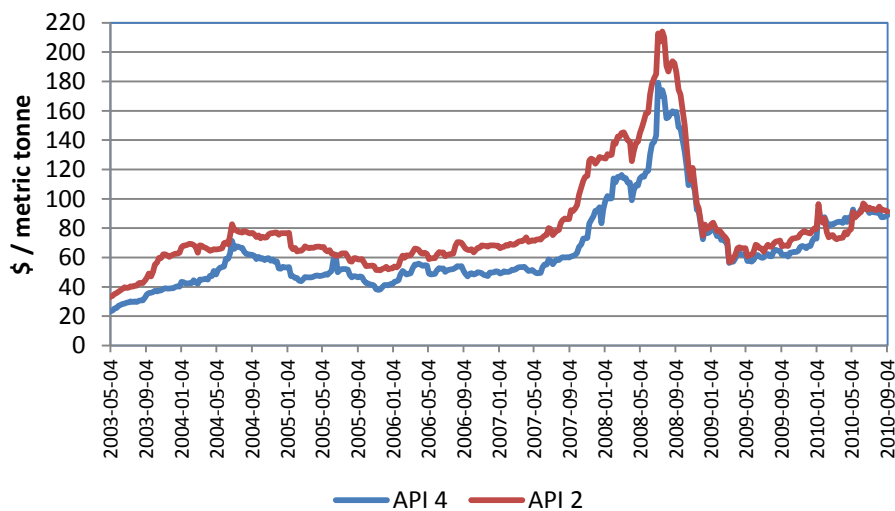


Source: McCloskey (2010)

Internationally, in recent years, we have seen a trend from longer term, annually- priced export contracts to more index priced and shorter term deals. The recent price spike is only one reason for this change in behaviour; another reason is the emergence of coal price indices. Export prices are captured in the API4 index which is a weekly published assessment of spot physical prices for FOB Richards Bay coal cargoes (published by Argus/McCloskey). API4 index prices are now also used as the basis of derivative contracts. Buying or selling coal against the index allows companies to manage their price risk by using forward contracts or swaps. Forward contracts are traded over the counter (OTC) bilaterally between parties and settled against the index. Coal derivatives started appearing only in 1998 and took until 2002 to reach two times physical volumes. But the market is growing steadily and by 2007, paper volumes had reached a multiple of ten in the Atlantic market.

The long term trends in API2 (Europe CIF) and API4 (Richards Bay FOB) are shown below.

Figure 13: API2 and API4 coal prices



Source: McCloskey Coal Price Index



## 5. Coal policy, governance and regulation

### 5.1 Coal policy

#### *Policy lacuna*

It is a surprising fact that although South Africa's economy is overwhelmingly dependent on coal, especially for power production, and despite coal being the third largest commodity export earner (after platinum and gold)<sup>36</sup>, the country has no explicit coal policy. In part, this reflects the preoccupation of the democratic government, since 1994, with policies and programmes to increase household access to energy (especially electricity). Almost as a default, little attention was given to security of supply or broader industrial energy issues, which were assumed to be largely unproblematic. In the absence of government action, the largest coal user in the country, Eskom, has in recent years initiated a forum for government departments and enterprises to discuss electricity sector related coal supply challenges. And, as we shall elaborate below, private coal companies have recently tried to bring all relevant stakeholders together to develop a "South African Coal Roadmap" which would help shape the future of the industry.

The latest official energy policy statement is the Energy Policy White Paper published in 1998, much of which is out-of-date. The coal section in the document amounts to only 3 pages out of a total of 102. It advocates continued deregulation, maintaining a coal resource database, promotion of low-smoke coals for households, the use of discard coal, promotion of end-use efficiency and clean-coal technologies and investigating the use of coal-bed methane.

A number of key policy questions remain unanswered. Chief amongst these is the issue of South Africa's carbon intensive economy and its potential future exposure to international climate change treaty commitments aimed at reducing greenhouse gas emissions. South Africa's commodity exports, whose production currently depends on coal-based electricity, may face carbon tariff barriers by its major trading partners. These possible future developments have a direct bearing on investment decisions around additional coal-fired stations (which are currently the cheapest electricity generation option) or on another CTL plant (which could reduce South Africa's petroleum imports). These potential investments would have long term implications for domestic coal demand and emissions.

Two new coal-fired power stations are currently being built; hence CO<sub>2</sub> emissions will continue to increase until at least 2020. At that time, some of Eskom's older coal power stations—built in the 1970s—will start being decommissioned. Should South Africa replace them with further coal-fired power stations or accept that there will be pressure to cap CO<sub>2</sub> emissions?

Additional questions are around the declining coal reserves in the Central Basin and the need for new mines and transport infrastructure to ensure continuity of coal supply to existing coal

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<sup>36</sup> In 2008, South African platinum exports amounted to R77.9 bn; gold exports were R43.9 bn and coal R42.4 bn (Chamber of Mines Facts and Figures, 2008). DMR data for the value of coal exports is lower, at R31.1 bn.

power stations. Or, if the plan is to start moving away from a carbon-intensive economy, are alternative energy resources being developed now that could replace coal?

Another key issue is whether South Africa will respond more purposefully and successfully to coal export opportunities in the East. If coal exports are to expand, a number of interventions will be necessary around more efficient allocation of prospecting and mineral resource rights and mobilisation of capital and public-private partnerships that would support major expansion of coal mining and rail infrastructure.

If South Africa does have a default coal policy, it could be summarised crudely as “export the best and burn the rest!” But even this default has run into problems with investments in rail capacity lagging those in coal mine and port capacity.

### *Eskom initiatives*

As mentioned above, this policy void is being tackled by two initiatives. First, Eskom is attempting to address its concerns around the quality, security and price of its coal supplies. Already announced coal mining investments will not fully meet expected power station coal demand. Furthermore, coal quality has been deteriorating, negatively affecting the performance of its power stations. And Eskom’s coal costs are escalating, placing pressure on electricity prices and its financial performance.

During Eskom’s power crisis in 2008, the utility assembled a task team of CEOs and senior managers in the coal sector in order to develop an emergency plan to restore Eskom’s coal stockpiles. Eskom has since taken much more seriously the whole area of primary energy procurement and management. During the course of 2008, the major coal companies made commitments to contribute additional allocations (even diverting a portion of planned exports) in order to respond to Eskom’s need. A senior coal executive was seconded from Anglo/Kumba to Eskom.

Eskom is pursuing a number of strategic actions: the development of an optimal portfolio of long, medium and short term coal contracts; movement to coal contract prices based on efficient costs and fair returns on capital invested by the mining industry; investment in rail and conveyor coal transport options (Eskom has established a working group with Transnet to facilitate rail solutions; the Majuba Rail project and combined road/rail container system for Camden are being implemented; and a feasibility study on the Waterberg rail link has begun); coal quality management and selective beneficiation, especially for Matla and Duvha power stations; risk based coal stock management; improved cooperation with major stakeholders; and strengthening of organisational capabilities in Eskom’s primary energy division.

Eskom has helped convene a wider Coal Energy Forum, including key government ministries, the mining industry, unions and Transnet, in order to tackle issues such as the development of scenarios of future coal needs, facilitating approval of coal prospecting and mineral rights, planning of new coal mining investments, accelerating required investments in rail and road infrastructure, and sourcing of key geological, engineering and management

skills. However, industry participants complain of a lack of government leadership and progress in these areas.

### *South African Coal Roadmap*

A second initiative is the South African Coal Roadmap which aims to identify the factors that will affect the sector going forward as well as the best options that can be followed for future development of the coal industry. It aims also to facilitate policy, planning and strategy development to achieve optimal outcomes. Participants include all relevant stakeholders in the coal sector. The process commenced in 2007, at the instigation of a handful of concerned coal industry leaders, but progress has been slow. Initial concerns around competition (anti-trust) law were raised but now appear to have been resolved. The Roadmap is being coordinated by the Fossil Fuel Foundation, an association of stakeholders involved in the coal sector. Focal areas are being established in geology (resources, reserves, exploration), coal characterisation and analysis, mining (handling, storage, environment), beneficiation, technology, economic, social, labour and skill development issues, infrastructure and logistics, current and new markets, safety, health and environment, climate change, and local and international policy and regulation. Stage one of the process—establishing the scope, work plan and governance structures—is essentially complete. Stage two, which is envisaged to take 12-18 months, will define the current state of the industry and produce a baseline plus alternative scenarios.

The Roadmap process faces many challenges and this initiative still has to demonstrate that it will lead to integrated policy proposals which will shape investment decisions and actions that will smooth the development and expansion of the coal industry, including meeting local demand and export growth opportunities. The involvement of government has also been complicated by the recent split of the Department of Minerals and Energy into two separate government departments—the Department of Mineral Resources and the Department of Energy—each with its own Minister. Coal prospecting and mining rights are controlled by the Department of Mineral Resources without any explicit reference the broader energy policies and plans being developed by the Department of Energy.

## **5.2 Legislative framework**

Developments in the coal sector have been affected by key legislative interventions over the past decade. First, there has been a concerted effort to increase ownership and participation by black South Africans in the economy and in the mining sector. Second, and related to these objectives, has been a fundamental overhaul of the licensing regime for prospecting and mining. The impact of these initiatives has been a dramatic increase in black-economic empowerment: currently over 30% of coal mines, as well as the Richards Bay Coal Terminal, are owned by companies controlled by black South Africans. A third development has been a new royalty payment regime. These legislative changes, coupled with bureaucratic delays

and uncertainties around prospecting and mining rights, and the implementation of new royalties, have had the combined effect of slowing investment in the sector.<sup>37</sup>

South Africa's Constitution provides for redressing historical socio-economic inequality and discrimination. Black economic empowerment (BEE) is central to government's economic transformation strategy of empowering historically disadvantaged South Africans (HDSAs).

The Broad-Based Socio-Economic Empowerment Charter for the South African Mining Industry (signed in 2002) and the Broad-Based Black Economic Empowerment Act (2003) have established targets for increasing HDSA representation in management to 40% within five years and transferring ownership of 26% of mining assets to HDSAs within 10 years.

Black-empowerment objectives were incorporated in the Minerals and Petroleum Resources Development (MPRD) Act No 28 of 2002.<sup>38</sup> The Act also heralded a profound change in mineral resource rights. Previously owned by the land-owner, the legislation transferred ownership of these rights to the state which is now empowered to grant, control, administer or refuse prospecting or mining rights, subject to various conditions. Since 2004, when the legislation became effective, there has been an extended and laborious process to convert "old order" to "new order" rights.

The new legislation creates a "use it or lose it" principle. The holder of *unused* "old order" rights had exclusive rights to apply for "new order" prospecting or mining rights within one year. The holders of *active* "old order" prospecting or mining rights had to apply for "new order" rights within two and five years respectively, failing which the rights would lapse.

Codes of Good Practice for the Minerals Industry were gazetted in April 2009, in terms of the MPRD Act, and further define objectives in terms of black ownership, management control, employment equity, human resource development, preferential procurement, community and rural development, beneficiation, and housing and living conditions. The codes reaffirm the objective of attaining 26% ownership (in terms of voting rights, economic interest and net value) by HDSAs by 2014 but controversially the Codes require that the full ownership values embedded in BEE deals be reached within two years of transactions, implying that debt incurred for acquiring shareholdings be fully redeemed within that time period.

Conversion or granting of mining rights may be refused if these empowerment objectives are not met. There are also specified periods for prospectors or miners to commence their operations. Prospecting or mining rights may only be transferred with the permission of the

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<sup>37</sup> Coal mining is also subject to the Mine Health and Safety Act of 1996 (amended in 1997). Government also offers some investment incentives. For example mining capital can be depreciated at 100% in the year that it is spent, provided there are profits to offset this against, alternatively in the following years.

<sup>38</sup> The Act is administered by the Department of Mineral Resources. The department's Mineral Policy and Promotion Branch is responsible for formulating and promoting mineral-related policies that aim to encourage investment into the sector. The Mineral Regulation Branch grants prospecting and mining rights in terms of the Act and promotes mineral development and black economic empowerment. It is responsible for co-ordinating and liaising with national, provincial and local government structures for efficient governance. It is also tasked with addressing past legacies with regard to derelict and ownerless mines and enforces legislation regarding mine rehabilitation by means of regulated environmental management plans.

Minister. A change of control over prospecting or mining companies also requires Ministerial permission.

The Mineral and Petroleum Resources Royalties Act of 2008 introduces new royalty taxes on minerals. The Act took many years to finalise. It was due to be implemented in May 2009 but implementation has now been postponed to 2010. Royalties will be capped at 5% for refined minerals and 7% for unrefined minerals. Effective rates can be a lot lower. Coal is classified as an unrefined mineral. The royalty is calculated by the gross sales multiplied by a percentage equal to  $0.5 + [\text{earnings before interest and taxes} / (\text{gross sales in respect of unrefined mineral resources} \times 9)] \times 100$ .

While these policy and legislative initiatives have had a positive effect on black-economic empowerment, the overall impact on the mining sector in South Africa has been more mixed. Investment and production of most commodities in South Africa has stagnated or even declined over the past decade and South Africa mostly missed the global commodity boom in the period up to 2008. In part this was because some of the ore bodies are becoming more difficult and expensive to mine. Inadequate infrastructure has also been a constraint. But it seems likely, that delays and inefficiencies in implementing new legislation have dampened investment in the sector.

## **6. Market drivers and scenarios**

Looking to the future, it seems clear that the development of South Africa's coal industry will be driven, firstly, by domestic electricity demand and, secondly, by export demand from countries such as India and China.

Coal consumption in South Africa will continue to be dominated by the existing stock of coal-fired power stations, the first of which will only be decommissioned from 2021. Whether any more power stations will be built after the two which are currently being constructed, and whether another CTL plant is built (the next biggest domestic coal demand sector) will depend on precautionary steps South Africa might take to reduce its carbon-intensity and greenhouse gas emissions in the face of global concerns around climate change.

Demand for South African coal exports are expected to decline in Europe as it decarbonizes its power sector, but will increase especially in India, and also China and other countries in the East. This demand is being driven by rapid economic growth and arguments that these countries' per capita and per GDP CO<sub>2</sub> emissions are still way below OECD averages. However, South Africa's ability to respond to this growing demand will depend on the development and implementation of a coordinated investment strategy in new mines and rail capacity to get the coal to its ports.

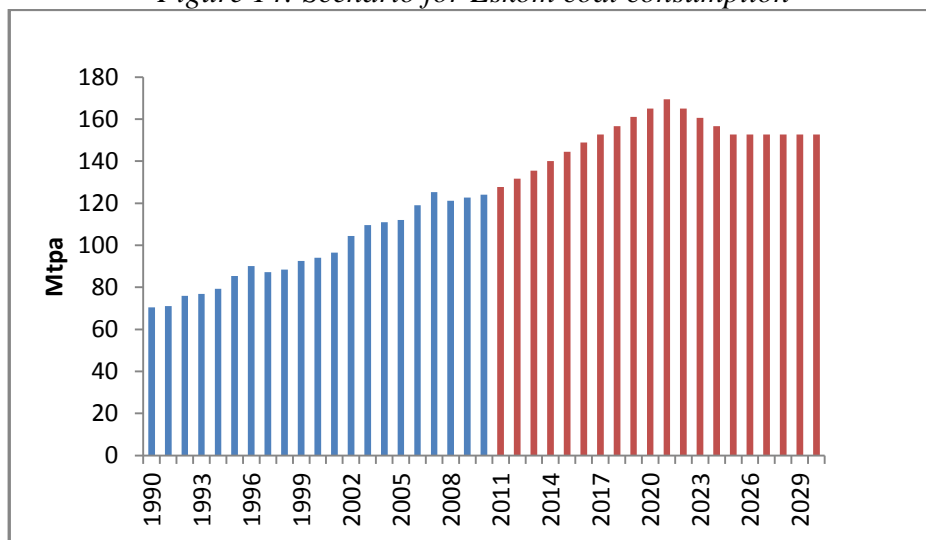
## 6.1 Expansion of coal production will be driven primarily by domestic power demand

The major driver in the development of domestic coal markets is undoubtedly Eskom's investments in further coal-fired plant. In 2008, Eskom has estimated that it would need around 200 Mtpa of coal by 2018 and that South Africa would need 40 more coal mines at an investment of R100 billion. A number of old mines are nearing the end of their useful life and, according to Eskom estimates, new mines will have to contribute around 180 Mtpa within 10 years to meet Eskom, Sasol, other domestic and export demand.

Eskom's estimates are definitely on the high side. Electricity demand fell in 2008/9 as a result of the recession and their forecasts have since had to be revised downwards. The author's own modelling (Figure 14) suggests that Eskom's coal demand will peak at a little over 155 Mtpa in around 2021, provided South Africa commits to CO<sub>2</sub> emission caps, as discussed in the next section.

The large Medupi and Kusile coal power stations will come on line between 2013 and 2020 and will increase domestic coal demand by around 30 Mtpa. Long-term contracted coal supplies to Eskom's existing power stations will also need to be supplemented with medium to short term contracts as plant is run at full capacity and adjacent mines struggle to meet demand. Private power plants (IPPs and self-generation) could add another 15 Mtpa by 2025. Overall coal consumption for power production will decline from 2021 when some of Eskom's oldest coal-fired power stations will need to be decommissioned. Between 2021 and 2030, approximately 10GW of coal-fired capacity will be taken out of service.

Figure 14: Scenario for Eskom coal consumption

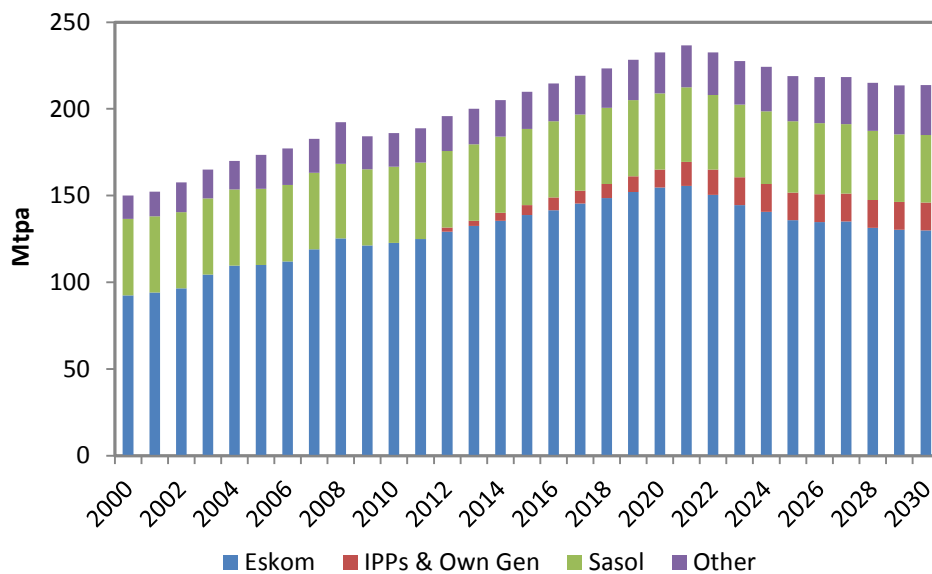


Source: Blue bars, actual (Eskom Annual Reports). Red bars, Author's own modelling assuming Medupi and Kusile power stations are built, older power stations decommissioned from 2021, emissions peak, decline and then plateau from 2025 at 275Mtpa CO<sub>2</sub>

While Eskom will account for the majority of growth in domestic demand for coal, Sasol’s plans to build another CTL plant might result in a step change in demand in the course of the next decade. If the proposed Mafuta plant is built, Sasol’s existing demand of around 44 Mtpa could increase to around 70 Mtpa. However, there is still a degree of uncertainty as to whether this investment will actually materialise; acceptance of CO<sub>2</sub> caps will make this CTL investment unlikely.

Figure 15 presents my modelling of total South African domestic coal demand through to 2030. Eskom and IPP demand is assumed to grow as indicated above and Sasol’s demand remains the same. Other domestic coal demand is projected to grow at a modest 2% per annum.

*Figure 15: Scenario for domestic coal demand in South Africa*



*Source: (actual 2000-2008; authors own modelling 2009-2030)*

What is clear from this analysis is that Eskom’s coal needs will continue to dominate the development of South Africa’s coal industry in the next decade, accounting for about two thirds of domestic demand.<sup>39</sup>

Exports could rise to 105 Mtpa by 2020, provided a number of dormant mining investment plans are revived, existing rail constraints are tackled and RBCT proceeds with its next expansion (rail constraints on exports are discussed in greater detail in later sections).

<sup>39</sup> If exports are added to projected domestic demand, then total coal production is forecast to rise to between 320 and 340 Mtpa by 2022. Local use will likely decline after that but exports could continue to grow provided rail and port capacity is expanded. Hartnady (2010) using Hubbertarian analysis predicts that South African coal production will peak at about 284 Mtpa in 2020.

## **6.2 Climate change concerns could result in domestic coal demand peaking soon after 2020**

South Africa has not yet finalised its climate change mitigation policy. However, it made a voluntary offer in Copenhagen in late 2009 to deviate below a “business-as-usual” greenhouse gas emissions scenario. Early indications are that the mitigation actions implicit in this offer are beginning to be incorporated into energy planning initiatives and are likely to impact on actual investment decisions.

South Africa’s CO<sub>2</sub> emissions from fuel combustion were around 340 Mta in 2006, making it the 15<sup>th</sup> largest emitter of CO<sub>2</sub> globally. Eskom’s coal-fired power stations account for around 220 Mtpa and Sasol’s CTL plants about 60 Mtpa. South Africa’s per capita emissions as a result of fuel combustion are 7.22 t CO<sub>2</sub> per annum compared to an OECD average of 10.93 and a global average of 4.28 t CO<sub>2</sub> per annum; and South Africa emits 2.03 kg CO<sub>2</sub> per \$ GDP<sup>40</sup> compared to a global average of 0.74 and the OECD average of 0.44 kg CO<sub>2</sub>/\$GDP (IEA, 2008).

While South Africa might justifiably argue that it is still a developing country or emerging economy and needs to foster rapid economic growth in order to create employment and overcome poverty, it also has to confront the reality that its carbon emissions are way above the global average and will need to fall in per capita and GDP terms, assuming movement to a level of resource usage which is equitable globally, i.e. equal per capita emission rights.

Policy debates in South Africa are also raising the spectre of tariff barriers by trading partners on its commodity exports because their production depends almost entirely on coal-fired electricity inputs. Further arguments are being made that South Africa needs to explore the potential benefits of developing competitive “green” industries and jobs, including in the renewable energy and energy efficiency sectors. While the country has huge potential to improve the efficiency with which it uses energy and hence carbon, and is becoming more efficient as energy prices increase and the structure of its economy changes (relying less on mining and more on service industries), energy conservation alone will not solve South Africa’s energy conundrum. Further energy supply options will be necessary and within this context some hard decisions will need to be made on coal’s future contribution to South Africa’s energy-economy and how many more coal-based investments South Africa should make.

South Africa is beginning to finalise its climate change mitigation strategy. Government has overseen the development of long term mitigation scenarios, and these were endorsed at Cabinet level in mid-2008, not as a specific policy but rather as a roadmap or set of strategic options. A National Climate Change Summit followed in March 2009 at which the then President announced that greenhouse gas (GHG) emissions will peak in 2025, plateau and then decline. At the Copenhagen summit in late 2009, President Zuma made a voluntary offer that South Africa would reduce its greenhouse gas emissions below a business-as-usual scenario by 34% in 2020 and 42% in 2025, conditional on “the provision of financial

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<sup>40</sup> Or 0.70 kg CO<sub>2</sub> per \$ GDP in PPP terms versus global average of 0.49 kg CO<sub>2</sub> per \$ GDP (PPP)



resources, the transfer of technology and capacity building support.” A National Climate Change Response Green Paper, published by the Department of Environmental Affairs in October 2010, reaffirms these commitments. A final White Paper, enshrining government policy on climate change, is expected in 2011.

The modeling underpinning these numbers suggests that South Africa would need to limit its total greenhouse gas emissions (fossil fuel combustion plus other sources) to between 500 and 550 Mtpa CO<sub>2</sub> equivalent. The electricity sector currently accounts for about half of South Africa’s electricity’s greenhouse gas emissions. If it were to take half the burden-sharing commitment, then CO<sub>2</sub> emissions from the power generation would need to be capped at around 275 Mtpa. If we add to Eskom’s current CO<sub>2</sub> emissions (220Mt) those from the coal fired power stations currently being built (more than 60 Mt ), then it is clear that the 275 Mtpa CO<sub>2</sub> will be breached by 2020 and will only be able to re-attained in 2025 when old coal power stations are decommissioned.

These assumptions have been incorporated into the preferred scenario in the Integrated Resource Plan for the electricity sector published by the Department of Energy in October 2010. The above targets can be met through a relatively modest increase in costs (less than 10 per cent above the least-cost, coal-rich scenario). However, deeper cuts in CO<sub>2</sub> emissions would result in significantly higher costs and are unlikely to gain sufficient industry and political support.

The modeling in Figures 14 and 15 assumes the above scenario. If the overall 500-550 Mtpa CO<sub>2</sub> equivalent cap is taken seriously, then there will be no room for Sasol’s planned Mafuta CTL plant.

The adoption of carbon capture and storage (CCS) technology, of course, would remove the above constraints on building further coal power stations or CTL plants. While South Africa has a modest CCS programme (mainly aimed at mapping geological sites for potential storage), it is unlikely to be able to afford the investment costs of this technology in the near to medium term and thus CCS is unlikely to impact on the above scenarios before 2025.

### **6.3 Domestic coal prices will rise as exposure to short term contracts increases**

Domestic coal prices in South Africa, on average around R170 or US\$23/tonne, are amongst the cheapest in the world, but domestic prices are rising, and are likely to continue to do so in the immediate future. This paper has documented Eskom’s increasing exposure to short and medium term road haulage coal contracts which are more expensive than its existing long term contracts with mines adjacent to its power stations. The growth of small mining companies has meant average industry costs have increased. Recent applications by Eskom to the National Energy Regulator of South Africa (Nersa) for electricity tariff increases have shown how primary energy costs are escalating.

A number of mines with Eskom coal contracts have also diverted better quality coals for more lucrative exports. Even though coal export prices have not revisited their 2008 highs, they are still much higher than domestic prices, even after allowances have been made for transport and beneficiation costs. Higher export prices have had some effect in pushing up domestic prices in new local contracts. However, the linkage between domestic and export prices should not be overstated. Eskom and Sasol account for 90% of domestic coal use. Three-quarters of Eskom's coal still comes from long-term contracts with tied collieries, and Sasol owns its own coal mines. And while it is true that the differential in quality between export and domestic coal has been diminishing, especially with lower quality coals being exported to India, these are still essentially two different brands of coal. Eskom and Sasol use high ash, low calorific value coal, while most the export coals are washed to improve their quality.

The clear trend is for domestic coal prices to increase. However both Eskom and Sasol are able to limit the full impact of these cost and market pressures.

#### **6.4 Growth in exports are constrained by policy failures and infrastructure constraints**

This paper has documented the potential for exports to grow. South Africa is a relatively low cost producer and sits on the cusp between Atlantic and Pacific coal markets. Yet South Africa has largely missed the commodity boom in the period up to 2008. Global trade in steam coal has doubled over the past decade. Indonesia has more than tripled its steam coal exports over the same period, Columbia has increased 2.4 times and Australia by 40% (IEA, 2009). Yet South Africa's exports have been stagnant and, in recent years, have declined. Legislative and regulatory risks have restricted investment, but policy and infrastructure planning failures have probably had a more significant and negative impact.

As noted above, in the 1970s, the South Africa state, in partnership with private coal companies, embarked an ambitious infrastructure programme to grow coal exports. There was remarkable success; as Figure 5 demonstrates, exports were lifted from negligible levels to a situation where the country is now ranked fifth globally as an exporter.

In contrast, there is no evidence today of the state focussing on the potential for growth in coal exports. And there is no coordination between the investment plans of coal miners, Transnet rail infrastructure and RBCT port expansion. The latter have bravely proceeded with expansion, but Transnet remains a bottleneck. And coal companies face challenges around investment decisions to expand mining production to meet domestic demand while weighing uncertainties around what might be possible in terms of expanded exports.

This situation is exacerbated by the progressive mining-out of the central basin (South Africa's most favourable export coal resource) and the shift to develop the more remote and challenging Waterberg field with its high ash and lower yield coals. The Waterberg is remote from industrial centres. It has one urban centre, a constrained water supply and a single

railway line with 3 Mtpa capacity for coal exports. Export possibilities from coal deposits in this region will only be economic if further multi-product mines are developed which supply also large quantities of low-grade coal for power or synfuel production, as well as smaller niche metallurgical product. Massive investment in expanded rail infrastructure for exports from the Waterberg will need to be committed<sup>41</sup> and water constraints will need to be overcome, including integrated management of competing water demands for mining, power production, irrigation and human settlements.<sup>42</sup>

Failure to develop an integrated and rational coal policy, coupled with domestic energy security concerns,<sup>43</sup> could result in short term and ill-judged initiatives to re-introduce export quotas and domestic price regulation—policies which historical data and analysis show held back the development of the sector in the 1950s and 1960s.<sup>44</sup> A Roadmap is certainly the most needed and urgent priority for the development of South Africa's coal industry.

## **7. Summary / conclusion**

In summary, growth in South African coal production will be driven primarily by domestic power demand. However, despite South Africa having a couple of hundred of years worth of coal reserves, and coal being the cheapest electricity generation option, environmental constraints (climate change, acid mine drainage, and water shortages) will more than likely mean that total coal-fired generating capacity will peak soon after 2020. Domestic demand for coal will plateau and then fall as old coal-fired power stations are de-commissioned.<sup>45</sup> Nonetheless, new coal mines will have to be developed as existing mines exhaust their reserves (especially in the Witbank coalfield) and as Eskom and IPPs (and perhaps Sasol) expand their production in the period before 2020.

Local coal demand will also be impacted by rises in coal prices as a result of increased exposure to higher-cost, short-term contracts and possibly carbon taxes.

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<sup>41</sup> Transnet has started feasibility studies on the Waterberg rail link with both Eskom and private mining companies.

<sup>42</sup> One development being considered is the raising of the Mokolo Dam wall, the main impoundment in the Limpopo water management area, which currently supplies Grootgeluk and Matimba. An additional possibility is water transfers from the Crocodile West- Marico Water Management Area and from the Vaal River downstream of waste treatment discharges from the Gauteng area.

<sup>43</sup> Eskom has been concerned around security of coal supply to its power stations. Also there remains some uncertainty around data on coal reserves and what would be a sustainable level of local and export production. Estimates of economically recoverable reserves and potential resources need updating. Security of supply concerns are likely to increase as production slows in the Central basin and if there are delays in increasing rail capacity from the Waterberg.

<sup>44</sup> For example, on 18 November 2010 the new Deputy Minister of Mineral Resources was quoted as saying that the department would look at whether it made sense to declare coal a strategic resource and to regulate exports so as to ensure preferential supplies to Eskom ([www.fin24.com/Companies/Govt-may-regulate-coal-exports-20101118](http://www.fin24.com/Companies/Govt-may-regulate-coal-exports-20101118))

<sup>45</sup> Depending on the CO<sub>2</sub> emission reduction commitments made post 2025, new coal power stations may be built to replace some of the old stations that have reached the end of their useful life.

The rise in domestic demand over the next decade will not necessarily constrain growth in exports. Indeed, in some instances there are good synergies in the development of both markets. As already explained, specific coal seams in the Central Basin can be economically beneficiated/washed for exports with the middlings fraction available as local steam coal. Other seams provide only low quality local steam coal and are not suitable for exports. And the economics of developing the Waterberg coalfield require multi-product mines. The superior profits earned on exports are an important source of investment income for expanding local mining.

While some of Eskom's power stations have suffered from increasingly poor quality coals (as better quality coals are diverted to exports), it would still be a mistake to re-impose restrictions on exports in favour of local supply. These are mostly separate markets. Any problems with deteriorating quality of supply to Eskom should be dealt with through tighter contract management.

Coal exports have huge macro-economic benefits in terms of South Africa's balance of payments and current account. The potential for substantial expansion of coal exports (especially to India) is constrained by the absence of an integrated coal development policy, more distant and more difficult to mine coal fields, water shortages and insufficient infrastructure, especially rail capacity to the ports.

The need for strong coordination between coal producers, Transnet, and RBCT, to strengthen SA's reputation as a well organised and reliable coal supplier, would seem obvious. But we have yet to see purposeful policy and investment actions that would resolve the asynchronous malaise between private mining companies and the state-owned railways. Transnet faces pressure for investing in expanded capacity on behalf of a large number of smaller producers, few, if any of whom, are prepared to sign long term take or pay agreements on rail freight. The coal majors have been prepared to do this in the past, but they have experienced caps on their export allocations as black-economic empowerment policies have focused on widening entry in the sector.

Growth in exports could come from both the Central Basin and the Waterberg. There will have to be consolidation and optimisation of mines in the Central Basin, while in the Waterberg, the requirements of opencast mining plus multiple washing processes, imply large-scale development and investment, and adequate access to technology, favouring the involvement of coal majors.

The contrast between the purposeful and integrated development of coal export capacity in the 1970s and the current mismatch between mines, rail and ports is striking. How do we explain this anomaly? The restructuring of the mining industry, with the entry of many, smaller and less capitalised companies has clearly disturbed the previous relationships between the main industry players and the previous government, and made co-ordination more difficult. The emphasis of government policy, and the new entrants, has been on changed ownership and access to mining and export rights, rather than on growing and expanding the sector.

But clearly, state-owned Transnet, itself, has been a major problem. The period after 1990 saw widespread changes in Transnet's management, declining performance, and inadequate investment for at least 15 years. Poor governance and inadequate incentives have contributed to these outcomes. While there has been a more recent attempt, through new management appointments, to improve efficiencies and financial performance within Transnet, rail capacity continues to lag port capacity. Recent engagements with the coal industry have been encouraging but they have not yet been translated into long term contracts that would facilitate new investment and expanded exports. These difficulties have been exacerbated by capacity challenges within government and an absence of cross-sector planning.

A new Planning Commission has now been established within the Presidency and there is the hope that it may also consider the issue of a more strategic and integrated development of coal exports. Coal is fundamental to South Africa's energy-economy. It is also a valuable export earner. The incentives are there for maximising the economic benefits from the coal industry within the constraints of environmental sustainability.

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# APPENDIX 1

## COALFIELDS OF SOUTH AFRICA

