

Coal deposits of South Africa - the future of coal mining in South Africa

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Abstract. This paper gives an overview over the deposits of hard coal in South Africa. South Africa is the fifth largest coal producing country in the world.

The first part deals with the setting and features of South Africa. The Second part focuses on the future of coal mining. The industry and companies play a prominent role in this discussion. Although the part of SA in the global economy of coal is an aspect of talk.

Introduction

The coal fields are located in a series of basins located in the north and east of the country. The Karoo System contains coal-bearing sediments of Carboniferous-Permian (Gondwana) age. (Larry Thomas, 2002) The Karoo basin covers two-thirds of South Africa and hosts the fluvio-deltaic sediments and coal deposits of the extensive Ecca Group (ca. 280-250 Ma). The Ecca Group Coal measures constitute more than a third of all coal reserves found in the Southern Hemisphere and provide the main source of energy for South Africa. (M.J. Viljoen and W.U. Reimold, 1999) The essential formation is the Vryheid-formation which slip off into the Volkskrust-formation. The oldest coal seams developed in a post-glacial surrounding and were completed in a stable depression on the south end of the Kapvaal craton. The younger coal seams in this formation were shaped in a surrounding of alluvial river and delta system. The melting and rising of the glaciers dominates the development of the coal seams. The coal seams of the Volkskrust formation are located in another setting between slate and a range up to 250 meters thickness. These coals have a low ash content and a high rank of coal which makes it to the best in South Africa. The youngest coalfields of the Karoo basin developed in a fluvio-lacustrine system with a moderate climate. The Molteno formation doesn't belong to the Ecca group. The Molteno formation is younger and

have a age around 215 – 208 ma. All coal fields are economically exploited mainly in the northern and eastern parts of the basin. (Fig.1.)



Fig.1. South Africa (www.sas.upenn.edu)

The coal seams are shallow and almost horizontal. They have been affected by numerous igneous intrusions which have produced a great variation in rank. The intrusions caused by the uplift of the drakens mountains. The important varieties are Sub-Bituminous coal, Bituminous coal and a less part of anthracite. From a particular rank of Bituminous coal on it is called Hard coal. In 2006 South Africa produced 244 million tons per annum of Hard coal, mainly for its local generating electricity. 93% of electricity is produced by coal. Another big part for the ambitious country is the export of mainly bituminous, thermal-grade coal with comparative low sulphur content.

South Africa is the fourth biggest coal exporter in the world. Currently Germany achieves 892 000 tons per annum of steam coal from South Africa. Therefore south africa is germany`s major partner for steam coal. The other way around Germany is the biggest import partner of South Africa with 14, 2% import products. Both countries maintain an intense relationship.

Coal Fields of South Africa

The coal mines are located in five provinces of SA (Fig.2.): In the Limpopo, Mpumalanga, Free State, Kwazulu-Natal and the Eastern Cape Province. Most collieries are concentrated around the towns of Witbank, Ermelo and Secunda. There are 19 official coal fields but 70% of recoverable reserves lying in just three of them: Highveld, Waterberg and Witbank (Fig.3.).

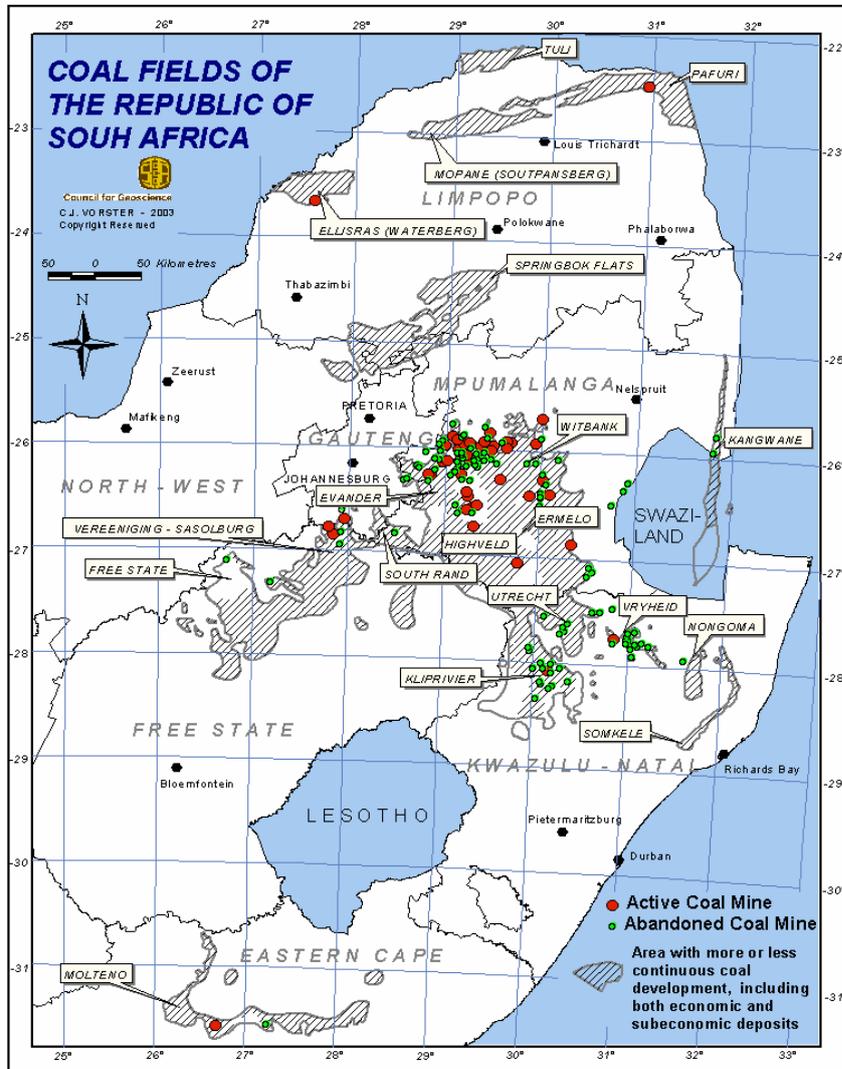


Fig.2.Coalfields of SA (C.J. Vorster-2003)

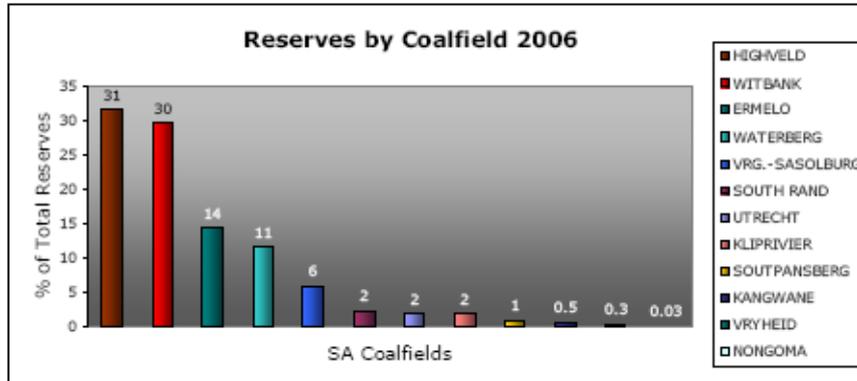


Fig.3. South Africa's Reserves by Coalfields(SA Mineral Industry 06/07)

Industry and the Future of coal mining

South Africa was built on mining and it remains the global centre for the industry, containing the world's largest gold and platinum group (PGM) reserves, as well as an abundance of coal, diamonds and iron ore. The mining industry as a whole employs some half a million people and indirectly employs 200,000 more.

The mining industry is the largest industrial sector in South Africa.(Annual Business Economic and Political Review. South Africa, 2008)

The three major coal producers and exporters are: viz. Anglo American Coal (Anglo Coal), Ingwe (a BHP Billiton subsidiary) and Xstrata (previously Duiker, with Swiss Glencore International as a major shareholder). Fig.4.

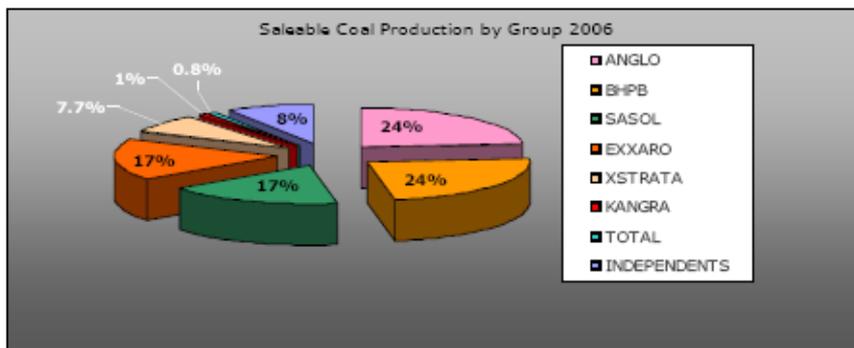


Fig.4. 2006 Coal Production by Mining Industry(SA Mineral Industry 06/07)

Eskom is a South African electricity public utility and the largest producer of electricity in Africa and the top seven utilities in the world. Eskom operates a number

of notable power stations, including Kendal Power Station, the largest coal-fired power station in the world.

Eskom got a lot of projects in all parts of national energy sector. For example two new coal-fired power stations.

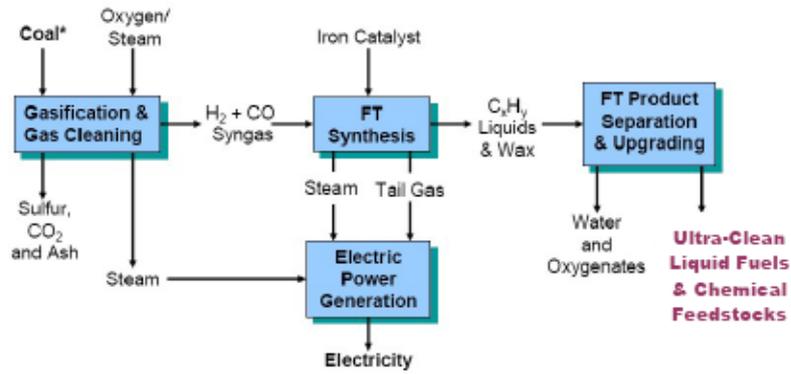
Since 1955 South Africa has been producing coal-derived fuels and is one of few commercial coal to liquids (CTL) producer in operation today. (Fig.5.).

Currently around 38% of the country's gasoline and diesel needs are produced from indigenous coal. The total capacity of the South African CTL operations now stands in excess of 160,000bbl/d.

The low price of coal compared to other fuels is a major driver and has generated significant interest in CTL fuels worldwide. The production of Sasol the national producer of synthetic fuel, secondary worlds largest producer, rises about 400% in the last years. The company has developed world-leading technology for the commercial production of synthetic fuels and chemicals from low-grade coal as well as the conversion of natural gas to environment-friendly fuels. Studies suggest liquid fuels can be produced from coal at around \$27 to \$45/bbl; well bellow 2006 oil prices which reached almost \$109,53/bbl in 2008. This high costs entice other Countries to use the same technology for supply of liquid fuels. The Shenhua Group for example China's largest coal producer just announced it aims to build a 50,000 barrels/day refinery to make ultra-low sulfur diesel and gasoline from direct coal liquefaction. With the Siemens Fuel Gasification Technology's (formerly Future Energy's) China wants to solve his fuel problems. Gasification technology is an entrained-flow pressure gasification system that gasifies a stream of pulverized coal (or atomized liquid fuel or a fuel slurry) with oxygen. Fig.6.

Shenhua is also building indirect coal liquefaction plants in partnership with Sasol and Shell. Overall, China will invest more than 128 billion US Dollar to develop alternative coal-based synthetic fuels projects to ease the country's dependence on oil imports.

Producing Liquid Fuels from Coal - Two Approaches



One method of producing liquid fuels from coal is the Fischer-Tropsch indirect liquefaction process, which yields high quality transportation fuels, among other products (SOURCE: FT Solutions LLC).

Fig.5.Liquid Fuels from coal (www.nma.org)

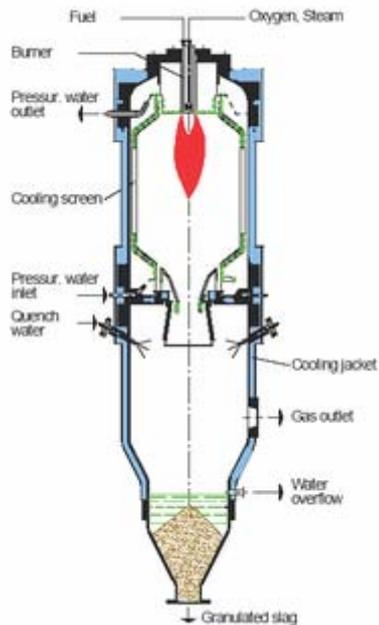


Fig.6. Siemens Fuel Gasification Technology (www.greencargocongress.com)

Another important technology is the Underground Coal Gasification (UCG) which is a process where coal is converted underground into a synthetic gas, which can be used as fuel for power generation or a raw material for chemicals. Fig.7.

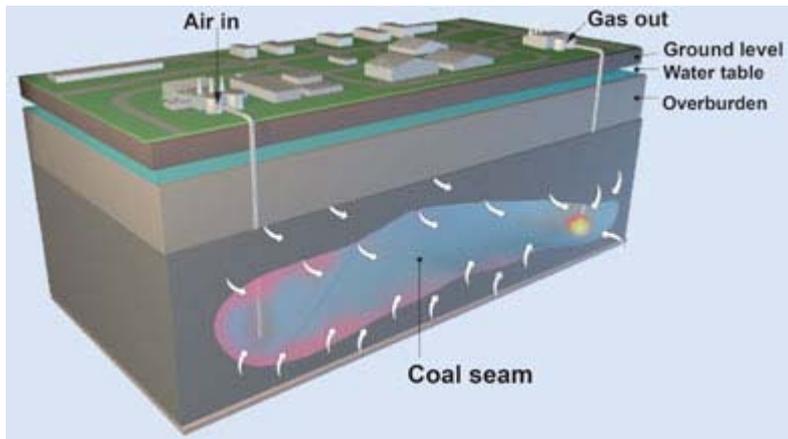


Fig.6. UCG production facility (www.rsc.org)

The government of South Africa is currently in the process of introducing a new suite of mineral laws, two of the principal objectives of which are to ensure that the state becomes the custodian of the country's mineral wealth and that previously disadvantaged sectors of the population have greater access to that mineral wealth. It is vital that in introducing these sweeping changes investor confidence does not become a casualty.

The first objective will be carried out through the transfer of mineral rights from private mining companies to the state, which is estimated to take five years. During this time, mining companies can apply for and receive licenses granting them the right to mine.

A second piece of legislation, the draft Mineral and Petroleum Royalty Bill, was released in March 2003 by South Africa's Department of Minerals and Energy. The bill proposes royalties on mining companies' gross revenue to be paid in addition to income tax. The royalty rates would vary by sector and range from 1 to 8 percent, the highest of which would be levied on the diamond industry. The gold and platinum sectors, however, would be assessed at 3 and 4 percent respectively.

Most of South Africa's export coal is dispatched through the Richards Bay Coal Terminal (RBCT) on the Kwazulu Natal north coast. RBCT has an expansion programme which should result in its annual handling capacity being increased by 10 Mt by 2006. Two thirds of this expanded capacity is to be allocated to smaller producers.

RBCT is the largest single export coal terminal in the world. Fig.8.

Opened in 1976 with an original capacity of 12 million tons per annum, it has grown into an advanced 24-hour operation exporting more than 68 million tons of coal.

Richards Bay Coal Terminal has reached yet another important milestone in its history by increasing its design capacity for coal exports from 72 million tons per annum to 76 million tons per annum, effective 1 January 2008. The increase is part of the Phase V Expansion

A further increase in capacity to 91 million tons per annum becomes effective in the first half of 2009



Fig.8. Richards Bay Coal Terminal(www.rbct.co.za)

The future of coal is therefore strongly linked to the commitment, or lack of it, to reducing emissions of greenhouse gases and to making technical progress on the fixing of carbon monoxide in the rock formations or in the oceans.

What of the future? That will depend on political decisions to be made in the years to come. But whatever happens, coal is going to remain a major energy source, at least during the 1st half of the 2nd century

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