



Unburnable Carbon:

Budgeting carbon in South Africa



About Carbon Tracker

Carbon Tracker is a non-profit organisation working to align the capital markets with the climate change policy agenda. We are funded by US and UK charitable foundations including Rockefeller Brothers Fund, Growald Family Fund, Joseph Rowntree Charitable Trust, Tellus Mater and Polden Puckham.

Background to the research

Following the publication of our global analysis, we are undertaking more detailed research at a regional level. This specific piece of research was commissioned by WWF and informed by engagement with representatives of the SA Government Employees Pension Fund (GEPF).

The 'Navigating Muddy Waters' report series represents a collaboration of work between WWF, Trucost, Carbon Tracker and SinCo that looks at the issues of carbon and water risks to investors as well as sustainable investment opportunities. This report forms Part 2 of a 5 part series.

Climate change and water scarcity are two of the main drivers that governments, civil society and business need to seriously address in the transformation of the global economy into one that is resource efficient, low carbon, resilient and equitable. As a significant provider of financial capital, institutional investors play an important role in our ability to shape this transformation. On the other hand, these same investors face material financial risks if they are exposed to companies that are unprepared for this economic transition.

The aim of the reports is to provide empirical research to investors in and regulators of the securities markets that can guide policy and investment strategies to support the transition to a resource efficient, low carbon, resilient and equitable global economy.

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Further information

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Executive Summary

Investing within a carbon budget

Institutional investors in South Africa and worldwide recognise that holding global warming to below 2 degrees is essential to maintain the potential for stable long-term returns. Delivering climate security will require South Africa's capital markets to make a strategic transition from a high-carbon to a low-carbon pathway. This report aims to assist this process by highlighting the range of potential implications of a South African Carbon Budget for the stewardship of assets in the coal sector. More specifically this is of interest to universal investors such as the Government Employees Pension Fund (GEPPF). These investors have significant holdings in Johannesburg listed stocks, and are keen to understand their role as an investor in South Africa's low carbon future.

South African carbon reserves

An analysis of companies listed in South Africa indicates they have coal reserves equivalent to 38.9 GtCO₂ emissions (equivalent to 44.07 GtCO₂e when other greenhouse gases are included as well as carbon dioxide). Half of these reserves are located in South Africa, with significant reserves also in Australia and Botswana. The reserves outside of South Africa represent the interests of multinationals such as Anglo American (AGL) and BHP Billiton (BIL), in contrast to the purely domestic focused operators, led by Exxaro (EXX) and SASOL (SOL).

Development of further resources

The mining companies also have interests in coal resources which are yet to be developed to a stage where they are proven to be commercially viable. They are currently investing capital to bring these interests to the market, which could double or triple the level of reserves. Coal of Africa (CZA) for example has large stated resources which it is seeking to develop. Investors have a role to be actively engaging in how capital is employed by companies.

Export potential?

South Africa exports around 30% of its coal, with an increasing share destined for Asian markets as demand in the Atlantic market declines in part as a result of emissions constraints. Expanding exports further would require significant investment in infrastructure and would also rest on the assumption that coal demand would expand unchecked in Asia. However, China's rate of growth for coal-fired power is set to slow as a result of structural economic change, air pollution controls, water stress and new carbon policies.

Changing coal demand

The International Energy Agency (IEA) has produced scenarios which provide a range of future markets for coal. These range from continuing increasing demand, through stagnation, to declining demand post 2020. This could apply both to domestic and export markets, and indicates the shift in unabated coal use required to deliver emissions reductions. These scenarios represent the impact of a range of factors, including technological developments, regulations on carbon emissions and air quality, water availability, market shifts, and efficiency improvements.

Coal reserves exceed carbon budget

The South African government is considering a carbon budget for key economic sectors, with coal the largest contributor. The government's Long-Term Mitigation Scenario suggests a 'required by science' option which equates to a carbon budget of 16.4GtCO₂e from 2010 to 2050 for all sectors, not just coal-based activities. Our calculations indicate that current reserves earmarked for the domestic market are equivalent to 19.2GtCO₂e, with 17.7GtCO₂e attributable to companies listed on the Johannesburg Stock Exchange (JSE). If coal extraction and use is given a generous carbon budget of 12 GtCO₂e, this results in 38.5% of reserves set for domestic use no longer being needed.

Unburnable carbon: enough is enough

The critical conclusion of this analysis is that South Africa will have no room within its carbon budget for the development and combustion of new coal reserves through to 2050. This has profound implications for national economic strategy, business plans, as well as investment allocation and stewardship. This raises a question over the value of investing capital in developing further resources which are not compatible with a low carbon future. Mining companies are currently pouring capital into projects which could double the amount of coal available to South Africa.

New strategies required

This 'Unburnable Carbon' has implications for the strategy of the companies active in this sector. Diversified multinationals have other mineral interests to pursue which are not as carbon intensive. However with contracting western markets and saturated Asian markets, the future of coal is not certain. For the South African domestically focused operators, some have export activity already, but they face a real challenge to align their business within the 'required by science' carbon budget.

New opportunities required

Responding to this profound challenge will require a concerted effort by all stakeholders - government, companies, employees, mining communities and investors - to design a credible plan for coal as part of the transition to a prosperous, low-carbon South Africa. Alternatives to coal-fired electricity generation and coal-to-liquids oil production will form an opportunity to grow new and sustainable business and employment to replace jobs lost as the coal market declines. But in order for this to take place as rapidly as possible, investors will need to make sure they communicate their desire for products which support this shift (e.g. green bonds) to enable capital to be reallocated.

Carbon constrained valuation

Analysts are also starting to take note of the potential implications of a carbon-constrained coal sector for their valuation models. The impact on revenues and the increased uncertainty can affect the discounted cashflows and earnings multiples normally applied. Understanding how different future carbon-constrained demand levels could affect each company should become a standard approach.

Recommendations

Investors should:

- Challenge the CAPEX strategies of coal miners
- Request alternative valuation models from analysts
- Identify opportunities for growth in a low carbon economy
- Review the asset allocation strategy

Accountants should

- Consider the impact of a carbon budget on reserves when producing integrated reports

Extractives companies should

- Disclose the carbon emissions potential of reserves
- Articulate business strategy & capital expenditure aligned to a carbon budget

Regulators should

- Put measures in place to address systemic risks such as climate change
- Address structural issues which prevent investors acting to create sustainable value

Foreword

As an African institutional investor committed to seeking long-term and sustainable investment performance for our members and pensioners, the Government Employees Pension Fund (GEPF) welcomes this research series. The analysis provides insights into systemic carbon and water risks (and opportunities) facing asset owners and institutional investment managers in South Africa. The report furthermore proposes recommendations to governments, regulators, business, civil society and investors by giving guidance on how best to address our shared exposure to these risks.

In our view, climate change and water scarcity are two of the main drivers that we need to seriously address in the transformation of the South African (and global economy) into one that is resource efficient, lower in carbon emissions, resilient and equitable. As a significant provider of financial capital, institutional investors – such as GEPF – play an important role in shaping this transformation towards a more greener, sustainable economy and planet. GEPF started its sustainability journey in 2006 when it became a founding signatory to the UN-backed Principles for Responsible Investment (PRI). In living out this commitment, GEPF has committed to following investment management and ownership practices that take environmental, social and governance (ESG) considerations into account when making investment decisions on behalf of our members and beneficiaries.

GEPF, as one of the largest institutional investors in South Africa with a significant allocation to domestic equities and bonds is often referred to as a ‘universal owner’ within the South African economy. As such, climate change and water scarcity are likely to have a significant impact on investment returns for GEPF’s equity and bond portfolios. This calls for action on the part of GEPF and other institutional investors in South Africa.

The South African Government has developed policies to address climate change mitigation such as the proposed introduction of a carbon tax and the strategies contained in the National Climate Change Response white paper. Such regulations and policies need to be supported by the investment community in order for such policies to take effect. GEPF is firmly of the view that in the interests of environmental sustainability the transition to cleaner energy and a greener economy is inexorable over the medium-to long-term. South Africans will have to shift the way they generate and use energy. This will amount to a fundamental repositioning that will require investment in clean businesses, projects, and technologies.

Institutional investors, including GEPF, can address these risks by developing appropriate investment strategies to:

- Assess the potential impacts of carbon emissions and water stress on equity risk premiums and bond yields;
- Develop investment policies and next-generation mandates to include carbon and water risks that include longer term horizons with key performance indicators (KPIs) to measure performance over time; and
- Understand the implications of a carbon budget on investments in high carbon emission sectors, such as the coal mining sector.

Lastly, and perhaps most importantly, we are confident that the move towards a greener, more resource efficient, resilient and equitable economy offers investors attractive risk adjusted investment opportunities. GEPF’s Developmental Investment Policy commits GEPF to actively invest in critical economic and social infrastructure – including investments that will help South Africa move towards a green economy. This commitment saw the GEPF through its investment manager, the Public Investment Corporation (PIC), partner with the Industrial Development Corporation (IDC) in subscribing to an IDC Green bond for ZAR5 billion that will see GEPF invest in renewable energy generation and energy efficiency projects in South Africa.

We look forward to engaging the investment industry and other key stakeholders on the recommendations of this research in order to appropriately address systemic carbon and water risks facing our country and continent.

John Oliphant, Principal Officer, Government Employees Pension Fund

1. Introduction

Carbon Tracker published its groundbreaking 'Unburnable Carbon' report in July 2011.¹ For the first time this compared global fossil fuel reserves, especially those owned by listed companies, with global carbon budgets. This made it clear that if the world is to achieve its climate change objectives, it cannot afford to burn unmitigated all the existing coal, oil and gas reserves over the next 40 years.

We focus on reserves as a forward-looking material indicator of an extractive company's business. This enables us to link our work with financial analysis and inform discussions on future energy and investment scenarios. Our analysis prompted questions from investors about how this scenario might play out – which reserves would be left in the ground as unburnable carbon? The work has also been picked up by analysts who see the trend for increasing constraints to the use of carbon and water intensive fuels. They have considered the implications for valuation of mining companies if future coal revenues are impacted by declining coal prices and demand.

In the US, there have already been examples of stranded assets creating unburnable carbon. The coal sector is experiencing a downturn due to low gas prices and new Mercury emissions standards making coal uncompetitive. This has seen new coal plants mothballed rather than run at a loss. US coal miners saw share prices fall and credit ratings downgraded in June 2012.² Patriot Coal filed for bankruptcy protection in September 2012 in order to refinance its debt.³ All of this has occurred without any national carbon tax or emissions trading scheme.

Investors, accountants and investment banks have also raised the systemic risk this issue poses to fossil fuel intensive markets.⁴ The London Stock Exchange is skewed towards extractives companies, with the level increasing over recent years. Investors are tied to the composition of the main FTSE indices, either through passive tracker funds or benchmarking of actively managed funds. Yet no-one is monitoring the level of fossil fuel reserves being listed in London, and the system is still not set up to identify systemic risks such as climate change.

In a previous national report we reviewed the geographic location of the coal reserves listed in London.⁵ This demonstrated how UK investors are exposed to climate change risk around the world through reserves being extracted in Australia and Indonesia and sold to Pacific markets. This latest research focuses on South Africa, which is a country with significant minerals activity and high exposure to coal. There is already interest in South Africa around how this issue should be addressed by South African investors and regulators.⁶ With South Africa introducing the King III Code on Corporate Governance and leading the development of integrated reporting, it presents an opportunity to factor in the carbon budget to reserves reporting.⁷

Investors, accountants and investment banks have also raised the systemic risk this issue poses to fossil fuel intensive markets.

The objective of the research is to understand what the expected South African Carbon Budget might mean for coal mining companies in South Africa. More specifically this is of interest to institutional investors such as the Government Employees Pension Fund (GEPF). The GEPF has significant holdings of Johannesburg listed stocks, and is keen to understand its role and responsibilities as an investor in South Africa's future. South Africa faces a number of challenges around the health and safety of its workforce, providing energy, and managing water resources. Dealing with these issues are fundamental to sustainable development and cannot be taken lightly.

2. Analysis of coal listed in South Africa

2.1 Coal reserves

Reserves have a 90% likelihood of being exploited and are as reported by the companies in compliance with the SAMREC code in South Africa, (see Appendix for further details). The following table shows the location of the reserves held by each company with coal interests that is listed in South Africa.⁸ The reserves are translated into gigatonnes of carbon dioxide (GtCO₂).

Ticker code	JSE Top 100	Australia	Botswana	Canada	Colombia	Indonesia	Kazakhstan	Russia	South Africa	USA	Total (GtCO ₂)
AGL	Anglo American	2.09	6.66	0.13	0.70				2.46		12.04
ACL	Arcelor Mittal							0.46			0.46
ARI	ARM								0.59		0.59
BIL	BHP Billiton	8.80			0.70	0.03			2.58	0.62	12.73
EXX	Exxaro								9.31		9.31
OPT	Optimum								0.60		0.60
SOL	SASOL								3.07		3.07
HCI	Hosken Cons Invest								0.10		0.10
Total (Gt CO₂)		10.89	6.66	0.13	1.39	0.03	0.00	0.46	18.71	0.62	38.90
Percentage		28.0%	17.1%	0.3%	3.6%	0.1%	0.0%	1.2%	48.1%	1.6%	
	Non-JSE Top 100										
CZA	Coal of Africa								0.08		0.08
PET	Petmin								0.06		0.06

Highlights

- Nearly half of the total reserves listed in South Africa are located in South Africa. The exchange also has exposure to Australia and Botswana through Anglo and BHP. This demonstrates how a 'South African' Index or related fund may appear to have a domestic focus, but in practice may be exposed to significant international risks. African Rainbow Minerals, Exxaro, SASOL, HCI, Coal of Africa and Petmin only have coal reserves in South Africa.
- These figures are based on the total equity share of reserves owned by each company included in the Johannesburg Stock Exchange (JSE), so that investors can understand the risk profile of the company.

2.2 Coal resources

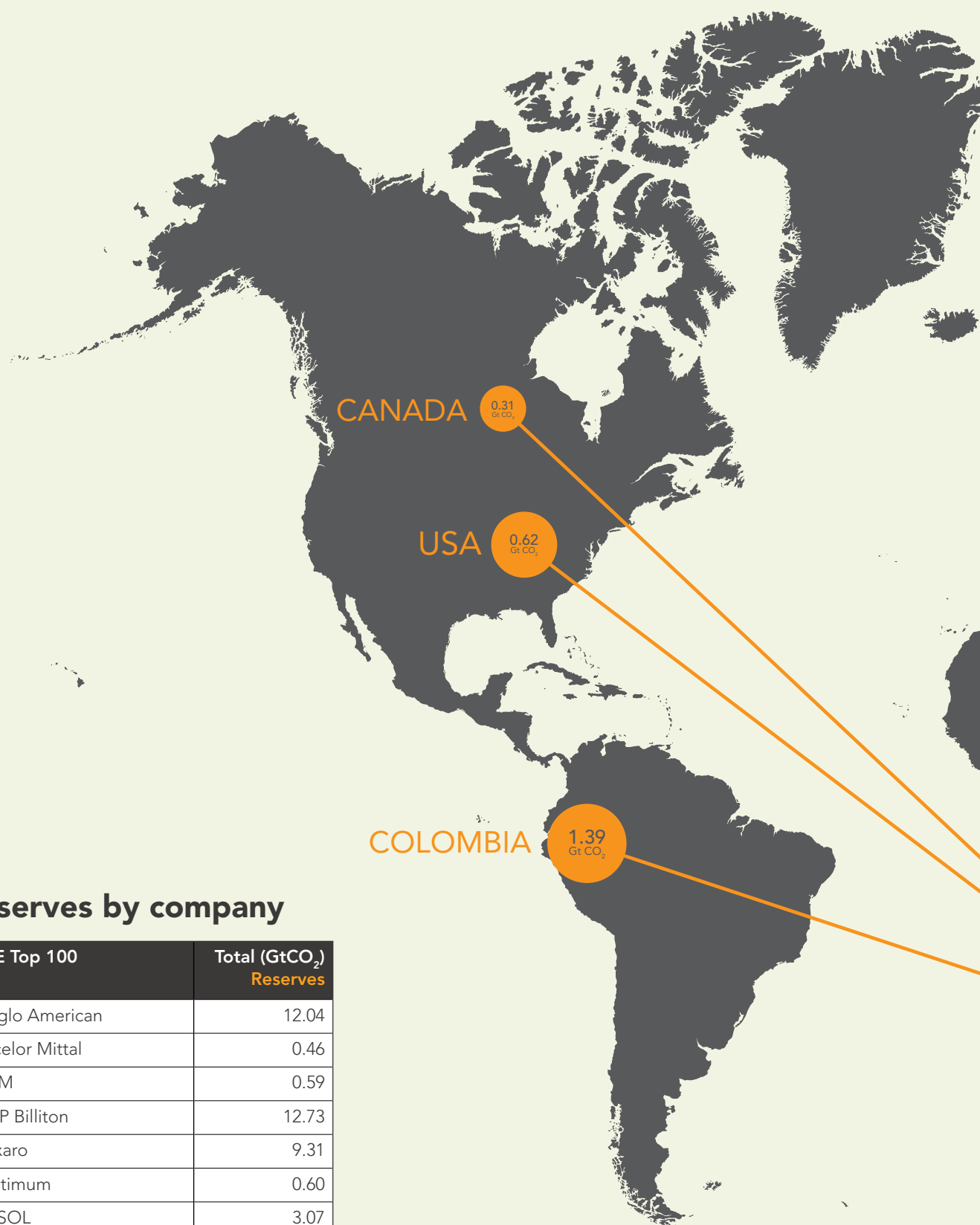
Beyond the coal reserves already developed by the companies, they also have interests in resources they are working to prove are viable deposits. These resources are classified as having a 50% probability of being exploited, (see Appendix for more details of the definition). The following table shows the carbon potential of the resources indicated by these companies (which are in addition to the reserves in the previous section). Not all of the indicated resources may ultimately be developed.

Ticker code	JSE Top 100	Australia	Botswana	Canada	Colombia	Indonesia	Kazakhstan	Russia	South Africa	USA	Total (GtCO ₂)
AGL	Anglo American	5.20		1.03	1.00				4.14		11.36
ACL	Arcelor Mittal						3.94	0.45			4.39
ARI	ARM								1.27		1.27
BIL	BHP Billiton	35.06			1.00	1.50			6.63	2.41	46.59
EXX	Exxaro								29.76		29.76
OPT	Optimum								1.23		1.23
SOL	SASOL								7.44		7.44
HCI	Hosken Cons Invest								0.10		0.10
Total (GtCO₂)		40.26	0.00	1.03	1.99	1.50	3.94	0.45	50.57	2.41	102.15
Percentage		39.4%	0.0%	1.0%	1.9%	1.5%	3.9%	0.4%	49.5%	2.4%	
	Non-JSE Top 100										
CZA	Coal of Africa								10.30		
PET	Petmin								0.14		

Highlights

- Just under half of the coal is in South Africa. If it is assumed that around a third of the further resources owned by JSE100 companies might become reserves, this would mean another 16.85 GtCO₂ of coal would be mined in South Africa, nearly doubling the level in South Africa. This is currently what the Capital Expenditure (CAPEX) of the companies goes towards – developing future production. This is likely to be incompatible with staying within the carbon budget required by science for the next few decades. Coal of Africa also has significant resources to develop which could add further to South Africa's reserves above the carbon budget.
- The overall ratio indicates that there is around 2.5 times as much resources in the pipeline being considered for development as there are already booked as reserves – closer to three times in South Africa. This is where the CAPEX of the companies is spent – developing these assets for future production.

Map showing the location of coal reserves listed on the Johannesburg Stock Exchange (*from Section 2.1*).



Coal reserves by company

Ticker code	JSE Top 100	Total (GtCO ₂) Reserves
AGL	Anglo American	12.04
ACL	Arcelor Mittal	0.46
ARI	ARM	0.59
BIL	BHP Billiton	12.73
EXX	Exxaro	9.31
OPT	Optimum	0.60
SOL	SASOL	3.07
HCI	Hosken Cons Invest	0.10
		38.90



3. Context

3.1 South African Coal sector

According to the International Energy Agency (IEA), South Africa has coal reserves of around 28 billion tonnes, equivalent to over 100 years of production at current levels.⁹ Only around a quarter of these reserves (7 billion tonnes) are owned by companies listed on the South African stock exchange.

World Coal Association figures indicate South Africa produced an estimated 253Mt of coal in 2011, 77Mt of which was exported.¹⁰ South Africa therefore uses around 176Mt (70% of production) of coal per annum domestically. If consumption was stable at this rate between 2010 – 2050, it would use up around 7 billion tonnes of reserves over the 40 years.

South Africa produces almost exclusively steam coal for electricity generation and around 93% of domestic power was produced from coal in 2011, (the highest level in the world). 70% of domestic coal consumption is for electricity generation by ESKOM, with 20% used for coal-to-liquids production by SASOL. The integrated business model of SASOL has its own mines supplying the majority of the coal feedstock for its Coal to Liquids (C2L) plant, supplemented by the big producers when required. SASOL produces around 160,000 barrels per day of liquid hydrocarbons (28% of domestic oil consumption).

Anglo, BHPB, Exxaro and SASOL are the four largest producers of coal in South Africa. The next largest is Xstrata, (which is listed in London, not South Africa). Together these 5 companies account for around 80% of production in South Africa.¹¹

“We are fully aware of the pressure to shift to a low carbon future and of the need to prepare for this reality...The challenge of balancing immediate energy security needs with the desire to move to a low carbon future is profound.”

SASOL Integrated Report 2012 (p49)¹²

3.2. South African coal exports

The major companies have varying levels of exposure to the export market.¹³ BHPB and Xstrata export the highest proportions of their production, with Anglo also exporting a significant amount:

Ticker Code	Company	Coal export production (Mt pa)	Percentage of SA production exported
AGL	Anglo American	16.6	29%
BIL	BHP Billiton	23.0	52%
EXX	Exxaro	4.7	11%
SOL	SASOL	0.0	0%
XTA	Xstrata	11.0	61%
		TOTAL	55.4
			(Average) 30%

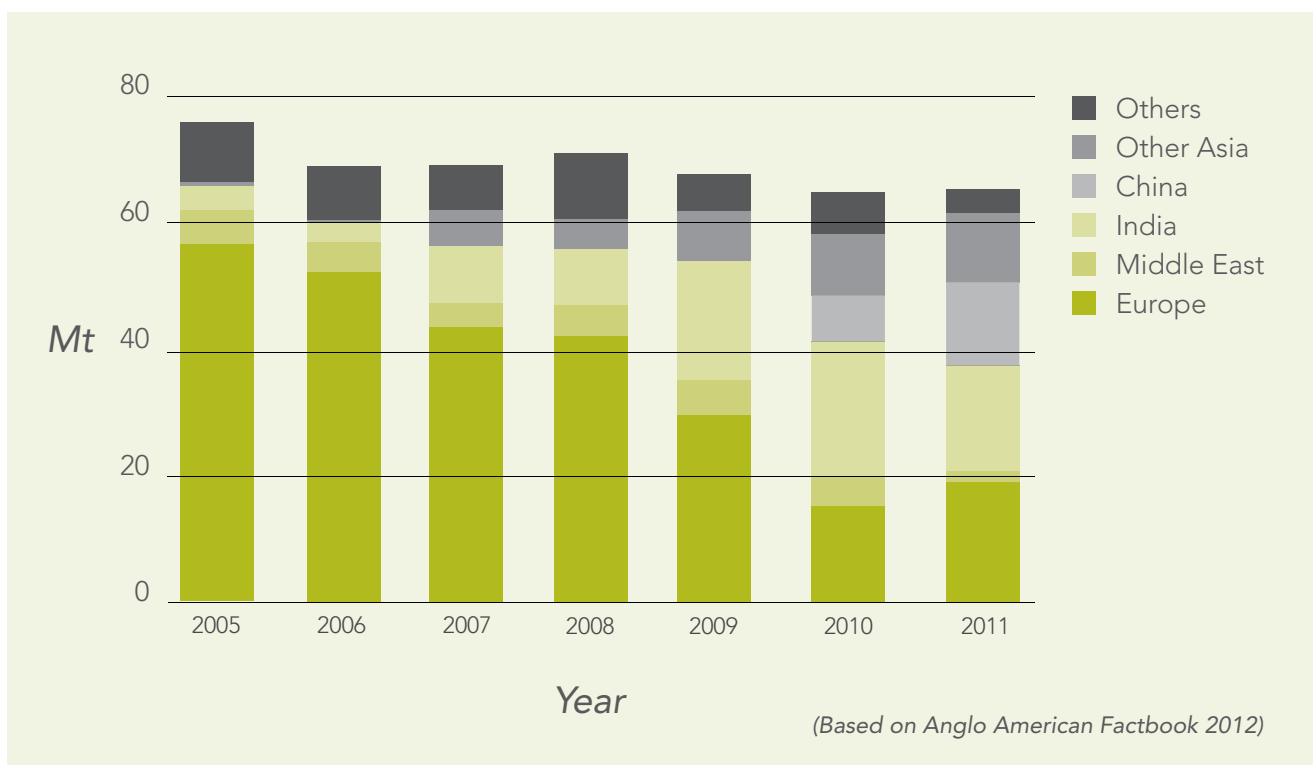
3.3 Coal export capacity / allocation

The Richards Bay coal terminal is the largest coal export terminal in the world, and the primary route for exporting coal from South Africa. The coal is transferred by rail from the inland coalfields. Port capacity has expanded over recent decades to a capacity of 91Mt per annum. Exports from Richards Bay in 2011 were around 66Mt. The unused port capacity reflects the fact that rail infrastructure to connect the mines to the port has not kept pace with the port development. The 91Mt is fully allocated amongst the coal producers, who are also shareholders in the port, with Anglo, BHPB and Xstrata having the largest allocations.

Since 2006, South Africa has started to swing away from supplying Europe to supplying the Pacific market. This reflects declining European demand and stronger Asian prices.¹⁴ South Africa is in a unique position in terms of being able to switch between the Atlantic and Pacific coal markets, however it is not in a position to rapidly increase exports as the infrastructure is not in place. Indonesian coal is cheaper to produce than South African coal, whilst Australian coal tends to be slightly more expensive to get to the export terminal, (the 'Free-on-Board' (FOB) price).

India has become a major market for South African coal in the last 3 years, whilst Europe has declined. China and other Asian countries have also started becoming significant markets for South Africa. (See diagram below).¹⁵

Exports of thermal coal from South Africa



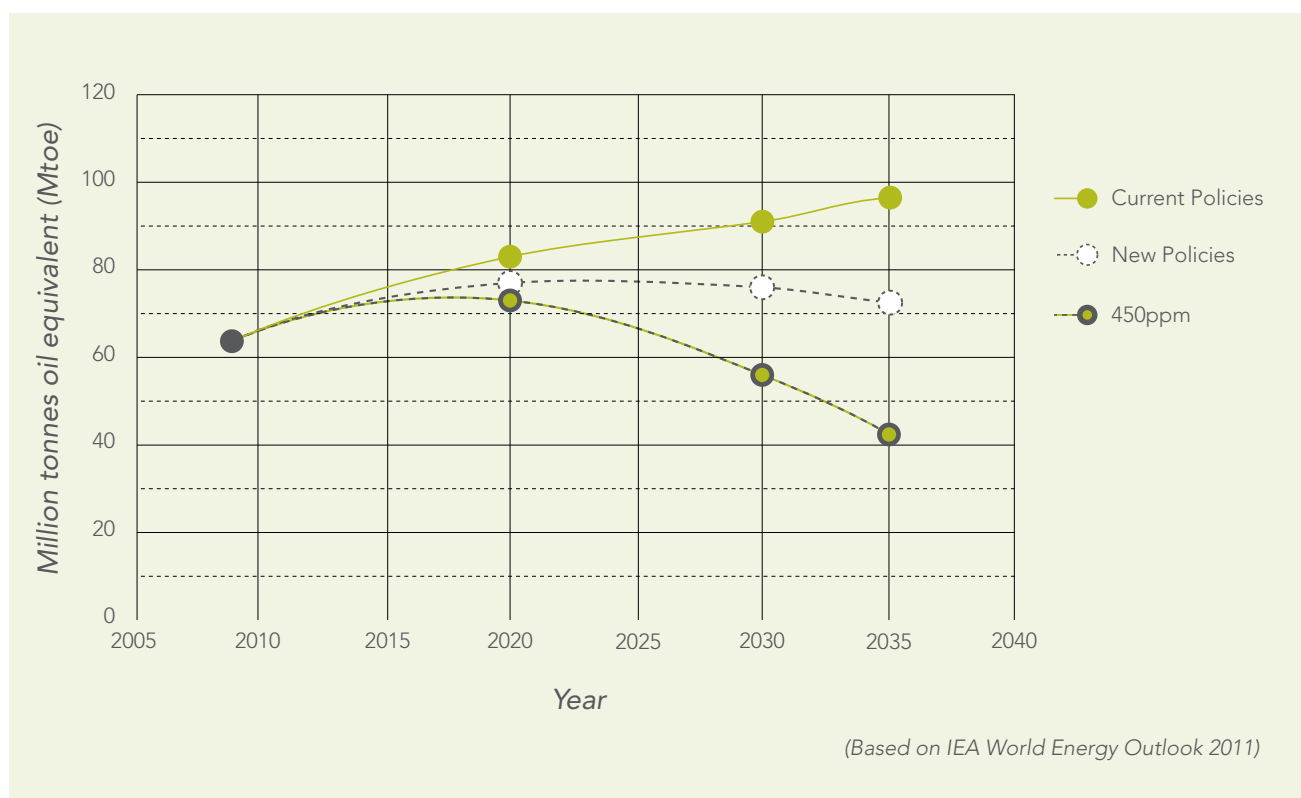
3.4 Future African coal demand

The IEA World Energy Outlook 2011 provided a number of scenarios for future energy consumption.¹⁶ These consist of the current policies scenario (rising emissions), new policies scenario (stabilised emissions) and the 450ppm scenario (reducing emissions to limit atmospheric CO₂ concentration to 450ppm). Even in the middle scenario, the IEA sees coal consumption in South Africa's export markets declining over the next couple of decades.

For Africa as a whole, the IEA scenarios provide a range of outcomes for future use of coal for power generation. As the graph below shows, there is increasing divergence over time leading to a significant difference in future coal demand.

The 450ppm scenario assumes that CO₂ pricing will have been introduced in South Africa by 2020. The IEA also notes that South Africa has one of the lowest proportions of fossil fuel energy subsidies which reach the poorest 20% of the country's population at just 2%. There have been efforts to provide access to electricity for all in recent years. Utilisation of more small scale renewable off-grid solutions is more likely to deliver this goal within the carbon budget.

Energy demand for coal-based power generation in Africa



The South African government names Carbon Capture & Storage (CCS) as one of 8 Near-term Priority Flagship Programmes in its National Climate Change Response White Paper, 2011.¹⁷ The government is currently developing a regulatory framework to cover CCS development. However CCS is currently an expensive unproven option to mitigate emissions. Sources of both domestic and international funding which can make this technology viable are yet to be identified.

Given the high uncertainty around the future of CCS, and the potential for renewable technologies to get even more competitive in the meantime, investors are not likely to make investment decisions based on CCS being in place. It may be informative to consider the impacts of CCS at some point in the future if investors are looking that far ahead.

3.5 The future global coal market

Any analysis of future coal markets requires certain assumptions around levels of demand, commodity prices, regulatory changes and the development of alternative technologies. The Pacific and Atlantic markets are becoming increasingly connected, with South Africa one of the main links.

The US has seen a difficult time for US coal producers in 2012, with cheap natural gas and new Mercury emissions requirements making coal uncompetitive. As a result many coal mining companies are looking to export markets. This could have knock on effects in other markets if competitive exports increase from the US. A common response to any regional constriction of the coal market (especially in developed markets such as the EU, US) is to point to the perceived insatiable demand of China and India. There is not as much certainty to this strategy as one may assume, due to a number of factors:

- China's economy may not be able to sustain its current rate of growth and there are already signs of the bubble straining at the edges.¹⁸
- China has already set carbon intensity targets, is taking action to improve urban air quality, and is developing a carbon trading system.¹⁹
- The varying quality of coal means it is not necessarily suitable for the power generating capacity seeking to import supplies. All tonnes of coal are not equal, and higher quality coal comes at a premium.²⁰
- As more markets seek to export, there will be increased competition, which will put pressure on prices and limit opportunities for some producers.²¹

"In our view as the Government Employees Pension Fund (GEPF), the next big systemic risk to the financial system and by extension pension funds' investments portfolios is the threat of fossil fuel assets becoming stranded as the shift to a low carbon economy grows."

John Oliphant, Investment and Actuarial Head, GEPF. (Writing for the Financial Mail)²²

The recent industrial action in South Africa during September 2012, following tragic events at a Lonmin mine, have put a spotlight on the mining sector. Workers at coal mines also started striking, demanding better conditions and pay. The weakening Chinese market saw overall coal exports fall. The monthly coal export from South Africa to China fell 60% from July to August 2012.²³ This is putting pressure on prices for South African coal.

Australia has the largest proportion (28%) of reserves held by companies listed in Johannesburg outside of the domestic reserves. Some of these reserves are metallurgical coal, and therefore the market depends partly on demand for iron and steel, rather than the power generation mix of Pacific markets. However there is a similar assumption that China and India have an ever growing demand for construction materials, despite the slowing of their economies.

Australia's thermal coal will be exposed to its new carbon tax, as well as concerns over water use in certain regions. The poor outlook and revised fiscal regime has led to job losses and project cancellations.²⁴ This shows that it is not just South Africa which will have to come to terms with a carbon and water constrained future.

Australia also exports up to three-quarters of its coal. The assumptions regarding China and India's coal use then come in to play. It is also worth noting that an investor in South African listed coal will have exposure to the Pacific market through interests in these different countries, which may end up competing for the market.

4. Carbon Budgets

4.1 A carbon budget in South Africa

The government has indicated it will be applying some form of carbon budgeting approach in structuring South Africa's contribution to tackling climate change. In its October 2011 White Paper, the government committed to the following:²⁵

"The initial Carbon Budgets for significant GHG emitting sectors and/or sub-sectors will be drawn up and adopted within two years of the publication of this policy and revised as required based on monitoring and evaluation results, technological advances or new science, evidence and information. A mechanism and process to translate the Carbon Budgets for each relevant sector and/or sub-sector into company level desired emission reduction outcomes will be developed and implemented within three years of the publication of this policy for companies above a minimum emissions threshold."

The mining and combustion of coal will only be allocated a proportion of a desired total country carbon budget. Historically, the emissions associated with the use of energy were 83% in 2000.²⁶ Given the contributions from coal mining emissions, coal to liquids production, coal-fired electricity production and other industry coal use, it could be estimated that extraction and combustion of coal were around two-thirds of the national emissions inventory in 2000. A more recent inventory has not yet been finalised and published at the time of writing.

Calculations based on the Long Term Mitigation Scenario (LTMS) indicate a budget of around 16.4 GtCO₂e between 2010 and 2050.²⁷ (GtCO₂e is gigatonnes of carbon dioxide equivalent, with the six main greenhouse gases converted into carbon dioxide.) Two South African CEOs wrote an article suggesting the total budget should be around 10 Gt CO₂, (equivalent to 11.3 GtCO₂e) based on the size of South Africa's economy and its current emissions levels.²⁸ The South African government has not yet determined what the desirable carbon budgets are across sectors.

There has not been an official report of South Africa's GHG inventory in recent years. If it is assumed that it has increased since the 442.4 Mt CO₂e figure reported for annual GHG emissions in 2000 (including land use change), then an estimate for 2010 would be around 500 MtCO₂e per annum. If a budget of 10.2 GtCO₂ (11.6 GtCO₂e) is applied to South Africa for the period 2010-2050, then this would mean that the budget would run out in 20 years time if emissions plateaued at this level.

In the UK, where a carbon budget approach has been enshrined in law through the Climate Change Act, the UK government agrees 5 year sub-budgets within the context of the overall emissions reductions targets to 2050.²⁹ Breaking down the budget into chunks assists in maintaining progress towards the overall goal. Otherwise there is a risk that emissions reductions would be left until later, meaning drastic cuts would be required, and costs to the economy would be increased.

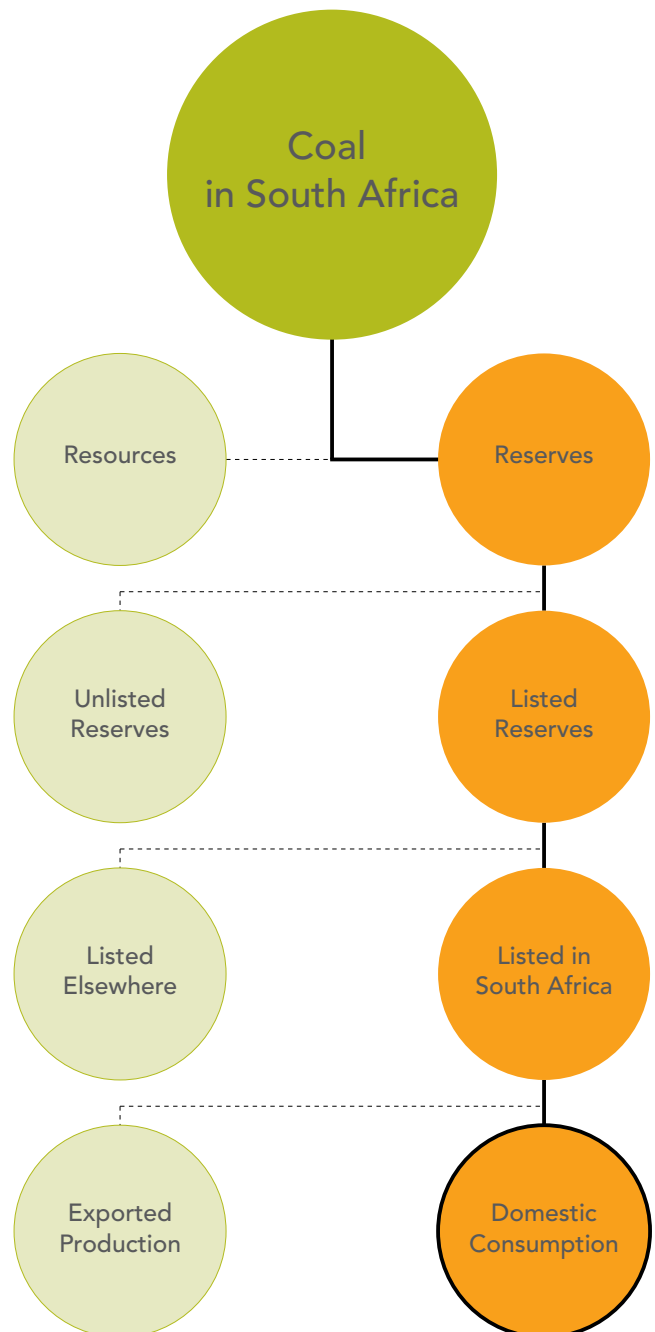
4.2 Comparing carbon in coal reserves to a carbon budget

The carbon emissions factors we applied to the reserves are for only the CO₂ emissions, not the other greenhouse gases (CO₂e). Based on the approach taken by the South African Department of Environment and Tourism, the 18.7 Gt of CO₂ stored up in the listed South African coal reserves would equate to around 21.2 Gt CO₂e.³⁰ If the current export proportions of these companies are applied to their reserves, this would still leave around 17.7 GtCO₂e as a potential contribution to domestic emissions by these coal reserves.

There are also reserves which are not owned by companies listed in South Africa. The other main corporate owner of these reserves is Xstrata (listed in London), which owns the equivalent of 2.8GtCO₂ (or 3.2 GtCO₂e). 1.7 GtCO₂e of this would be exported under Xstrata's current export split, leaving 1.5 GtCO₂e for domestic use. This means a total of at least 19.2 GtCO₂e is in South African reserves that would be expected to be used domestically if current export levels were maintained.

Beyond this there are the unproven resources in South Africa. If just one third of these coal deposits become proven reserves, then this would be another 16.8 GtCO₂ of emissions, or 19.0 GtCO₂e. So the resources double the level of coal on this basis.

The adjacent diagram summarises the slice of coal reserves we have considered to compare with the potential greenhouse gas emissions with a carbon budget for coal-related sectors in South Africa. This shows that we are only considering the reserves owned by companies listed on the Johannesburg Stock Exchange; and within those reserves we are looking at the portion that might be used domestically. This is to reflect what should be of interest for investors in South African equities for the purpose of this study.

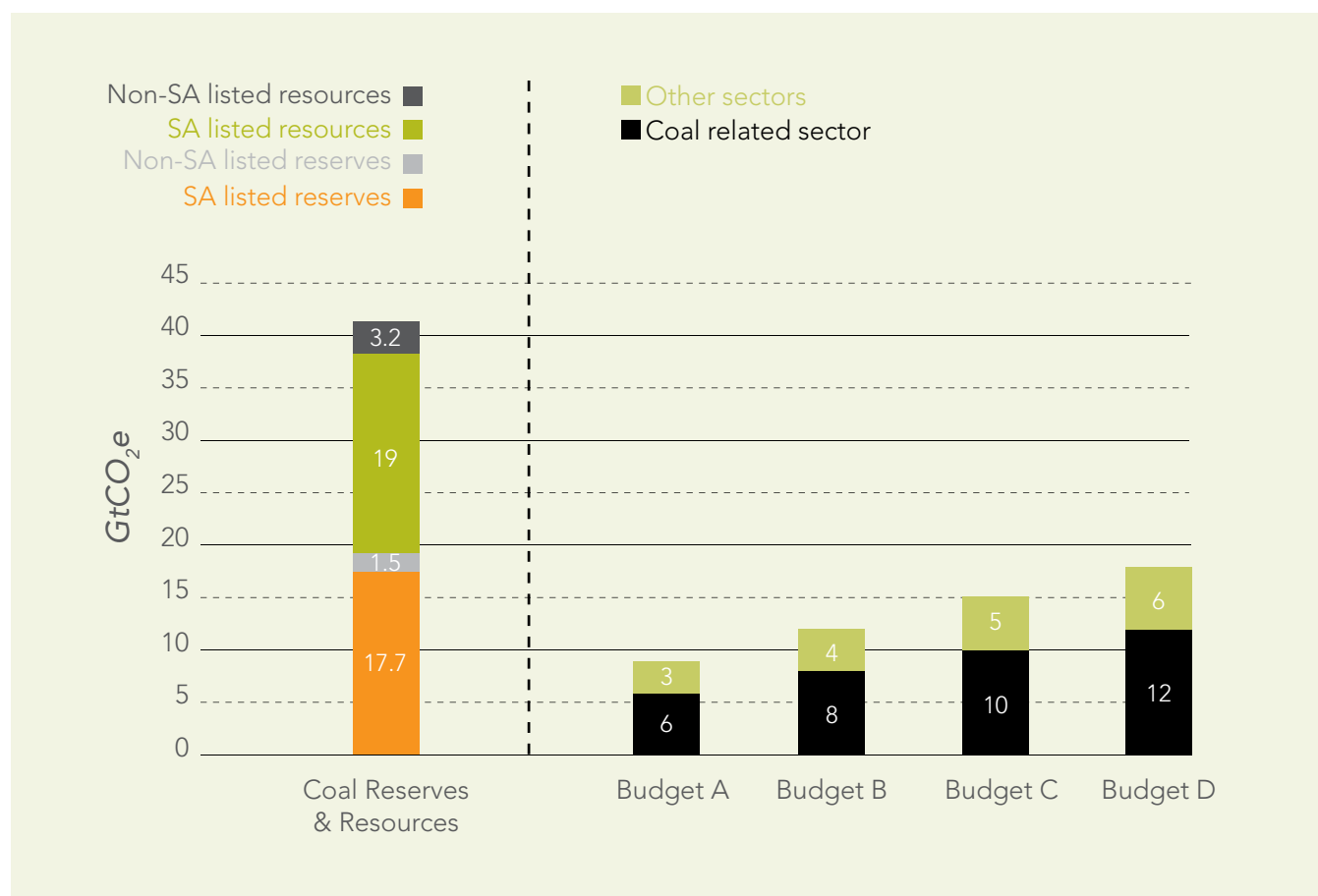


Based on current export levels, South Africa has 19.2 GtCO₂e of coal reserves earmarked for domestic use. This obviously exceeds the highest carbon budget of 12 GtCO₂e for coal-related sectors displayed below.

Without a confirmed figure for the relevant carbon budget it is not possible to say definitively how the coal reserves and resources compare. We use indicative levels in the following diagram to demonstrate how coal assets compare to some potential budget levels. These indicative budgets, (shown as A,B,C and D in the chart below), range from a total allocation across sectors of 9 to 18 GtCO₂e, with two-thirds of the budget (6 to 12 GtCO₂e) available to coal related sectors.

Based on current export levels, South Africa has 19.2 GtCO₂e of coal reserves earmarked for domestic use. This obviously exceeds the highest carbon budget of 12 GtCO₂e for coal-related sectors displayed below. None of the resources being explored in South Africa would be needed domestically for the next few decades, indicating capital should not be spent on this area.

Comparison of listed coal reserves and resources to potential carbon budgets



5. Investor exposure to South African coal

5.1 Coal weightings

GEPF provided their portfolio data for comparison to the JSE Top 100 Index. The constituents of the JSE Top 100 with coal reserves make up 20% of the Index by market cap (as at the end of March 2012). GEPF's South African equity portfolio consists of just over 200 companies, although holdings outside of the largest 100 holdings (by value) are not large and make up less than 2% of the portfolio. The companies with coal reserves make up around 17% of the overall portfolio. This proportion only increases slightly if we analyse just the top 100 holdings listed in South Africa.

5.2 An overview of the carbon exposure of the companies in GEPF's portfolio listed on the JSE:

The following table compares GEPF's portfolio with the composition of the JSE Top 100 as at the end of Q1 2012. (▲ indicates overweight; ▼ indicates underweight)

Ticker	Company Name	% of GEPF SA Equity portfolio by Mkt Cap	% of JSE Top 100 by Mkt Cap	GtCO ₂ in South African coal reserves	GtCO ₂ in South African coal resources	Coal export production (Mt pa)	Percentage of SA production exported
SOL	SASOL	▲ 5.96%	3.76%	3.07	10.51	0.0	0%
BIL	BHP Billiton	▼ 4.96%	7.86%	2.58	9.21	23.0	52%
AGL	Anglo American	▼ 4.19%	6.03%	2.46	6.59	16.6	29%
EXX	Exxaro Resources Ltd	▼ 0.83%	1.11%	9.31	39.07	4.7	11%
ARI	African Rainbow Minerals	▼ 0.51%	0.61%	0.59	1.86	2.5	61%
ACL	Arcelor Mittal SA Ltd	▼ 0.38%	0.39%	0	0.0	0.0	0%
OPT	Optimum Coal Holdings Ltd*	▼ 0.01%	0.15%	0.60	1.83	6.5	55%
CZA	Coal of Africa Ltd	▲ 0.01%	-	0.08	10.30	1.7	12%
PET	Petmin Ltd	▲ 0.01%	-	0.06	0.14	0.65	50%
TOTAL		16.86%	19.91%	18.75	79.51	55.65	

*Optimum Coal has since delisted from the JSE

5.3 Review of JSE100 mining company exposure to carbon budget risk:

SASOL

As a purely domestic operator focused on a GHG-intensive industry, SASOL obviously has high exposure to future carbon risk. It is difficult to see how South Africa can achieve its carbon reduction objectives if it maintains the current level and methods of producing liquids fuels. SASOL has no buffer from export markets.

BHP BILLITON

In the South Africa context, BHPB has a strong export position which would buffer any shift away from unmitigated coal use in South Africa. BHPB has global exposure to a range of mineral extraction activities. This diversification mitigates some of the risk at a group level. However BHPB has global exposure to the changing coal market, which should be reviewed by investors. For example under the IEA 450ppm scenario, BHPB's revenues from coal would decline, which are around 12% of group Earnings Before Interest, Taxes, Depreciation and Amortization, (EBITDA). This should be factored into company valuation models.

ANGLO AMERICAN

Anglo American is another diversified multinational mining operator. Its South African coal operations are more domestically focused than its peer BHPB, giving it greater exposure to the South African carbon budget risk. Coal makes up 22% of group EBITDA for Anglo, giving it greater global exposure to the coal market than BHPB. Again potential stagnation or reduction in global demand for coal over time should be factored into future valuations of the company.

EXXARO RESOURCES

Exxaro has huge reserves and is primarily focused on domestic customers. As such it is one of the most exposed companies to a South African carbon budget as it has a large store of carbon locked up in its reserves which is not compatible with a science-based carbon emissions budget for the country. The potential limitations on growth of this sector of delivering a carbon budget should be factored into the valuation of Exxaro. In turn this is likely to create opportunities for other companies who can supply cleaner forms of energy.

AFRICAN RAINBOW MINERALS

ARM has a better balanced position with significant export exposure established. This may dilute any reduction in the domestic market, but again it depends on how competitive they can be in the future Pacific market.

ARCELOR MITTAL SA

Arcelor in South Africa uses the limited metallurgical coal production to produce ferrous products, which it supplements with imports. The company therefore does not have the same exposure to potential stranded coal assets. However its business is dependent on a GHG-intensive coal-based process which maintains a level of exposure to the carbon budgets that will be agreed.

Focus on Implications for valuation of these companies.

Including potential carbon constraints into the financial analysis of coal companies is a new area. Analysts may have included some consideration of carbon prices for companies further along the value chain who burn fossil fuels, but have not typically done any macro analysis on demand changes relating to a carbon budget.

In putting together a valuation of a company, analysts can use a mix of earnings multiples and discounted cashflow (DCF) analysis. Earnings multiples assume that recent historical performance will be repeated, which relies on the company's ability to reproduce similar levels of returns on capital employed. If the market weakens with reduced coal demand, lowering the price and the level of sales, then this assumption may be compromised.

Discounted cash flow models also make assumptions about production levels, costs and prices. They adjust the value of future revenues according to a discount rate which determines the Net Present Value (NPV) of the company. If carbon constraints reduce the predicted revenues then the value of the company will be reduced.

Analysts can adjust various elements of their valuation models to reflect what may happen in the future. They can choose to adjust revenues, earnings multiple factors or discount rates. They may also take a view on the variation in exposure across the sector to apply company-specific adjustments. Analysts also determine the period over which they wish to run their analysis, often based on the level of certainty they can assign to the major factors.

Despite the short-termism of markets, the valuation models can go out reasonably long-term for the mining sector. The opinions expressed by analysts may influence short-term share-holding positions of asset managers, but can be based on performance predictions over decades. A recent research note from an Australian analyst on coal mining stocks stated:

*"Half of these companies' valuations relates to deposits that would be exploited in 10 years; a third relates to activities 15 years or more away."*³¹

This suggests that uncertainty over policy, technology and markets in the energy sector of 10 years time is relevant to the valuation of coal companies today. The level of impact on specific companies is also important to understand. A research output from a UK coal analyst indicated that:

*"Under a 450ppm scenario up to 44% of a global mining companies coal EBITDA could be lost."*³²

This approach integrated a global downturn in coal demand, and shows that coal revenues could be hit significantly. For diversified mining companies they have alternative minerals to rely on but pure coal companies do not have any other revenue sources to sustain the company.

6. What are the implications of these findings

6.1 For investors:

Challenge the CAPEX strategies of coal miners

Each company has a CAPEX budget to spend on developing more resources and ultimately future production. They are constantly considering investment decisions on major new assets. Shareholders should be questioning the continued viability of a business model which contradicts the required carbon budgets to tackle climate change. It is clear that South Africa will not need to develop any more coal reserves to stay within the country's carbon budget, yet companies are still looking to invest capital in maintaining and increasing production. If the company cannot come up with a better plan for investing capital then it should return it to shareholders.

Request alternative valuation models from analysts

Current valuation models are likely to assume consumption of coal will continue on the business as usual trajectory. To inform investor clients about the implications of alternative futures, some different assumptions can be applied. Adjusting revenue streams and terminal values to allow for declining demand will help investors understand the range of future values depending on the pathway South Africa takes. The varying exposure of different companies in terms of their global operations and their level of South African exports should then be factored in. The impact of the alternative scenarios depends on the type of model used.

Identify opportunities for growth in a low carbon economy

It is clear South Africa cannot meet the necessary carbon budgets to prevent dangerous climate change without a transformation of its energy base. Developing clean energy alternatives could also be a means of providing access to energy to the poor, as well as creating new sources of income. The promotion of this type of decentralised energy is intrinsically suited to empowering communities, compared to large scale industry. Identifying the new enterprises which can deliver mitigation measures and clean energy alternatives will be essential to the long term vitality of South Africa's economy and environment, as well as the funds that are invested in them. South Africa acts as a regional hub for its neighbours and has the opportunity to lead the way in shifting to a low carbon economy.

Review the asset allocation strategy

We would recommend pension funds review their asset allocation strategy in light of the findings of the research outlined above. It may also be informative to undertake an actuarial review of the risk profile incorporating the increased understanding that alternative valuations and consideration of future energy and emissions scenarios will bring. It should also be noted that if unmitigated fossil fuel combustion continues to increase, then other sectors will be affected by physical climate impacts. Agriculture, property, infrastructure and insurance will all be hit by the climatic changes that will result from exceeding carbon budgets. This means that it is not a situation where universal investors can do nothing.

6.2 Accountants

Consider the impact of a carbon budget on reserves when producing integrated reports

Accountants play a key role in developing and reviewing the information provided to the market and regulators. The developments prompted by the guidance on integrated reporting in South Africa make companies listing there at the forefront of corporate disclosure. Auditors and advisers therefore have a key role to integrate the reporting of reserves, emissions, climate change risk and asset valuation to take account of the potential impact of a carbon budget and the impaired assets that may be produced.

6.3 Extractives companies

Disclose the carbon emissions potential of reserves

Coal mining companies clearly have a strong interest in a future market for their products, as well as a responsibility to society to be accountable for the impacts of their products. Companies need to provide information about the emissions that are material to their business. For coal mining companies, that means the greenhouse gas emissions potential of their reserves, which are central to future revenue streams. This would provide investors with a forward looking material indicator of climate change risk.

Articulate business strategy & capital expenditure aligned to a carbon budget

It is clear that unabated coal is not compatible with the carbon budgets required by science. Yet mining companies remain bullish about the future repeating the past. If companies are serious about making a contribution to tackling climate change then they need to articulate how that translates into a revised business strategy. The board needs to explain to shareholders how capital will be redirected from unburnable carbon to alternative activities.

6.4 Regulators

Demonstrate to the market that measures are in place to address systemic risks such as climate change

The regulator of the exchange has the opportunity to provide the market with sufficient information to understand the systemic risks that may be developing. In particular by requiring the greenhouse gas potential of reserves to be reported, it can monitor levels on the market to ensure it is aligning with the future carbon budget requirements.

Address structural issues which prevent investors acting to create sustainable value

The current structure of relationships within the investment chain is not conducive to addressing the risks identified by this analysis. The inability to take a long-term view, the agency problems of measuring performance against short-term market benchmarks and the narrow definition of fiduciary duty all contribute to creating bubbles in the market. Financial regulators still need to get to grips with how to require a focus on creating long-term shareholder and stakeholder value.

Appendix: Methodology

Reserves and resources data

Coal reserves and resources data was provided by Raw Materials Group (RMG). More information is available at www.rmg.se. RMG collect data from companies and amalgamate it in their databases. South African companies report reserves and resources according to the SAMREC code which feeds into the Johannesburg Listing Rules. The SAMREC code has compatibility with some of the other regional reporting frameworks, including those from the UK, US, and Australia, which are of relevance to the companies analysed here.

The reserves and resources data was based on the most recent reported information on reserves as disclosed at July 2012. As with any snapshot analysis, ownership of reserves will continue to change and reserves will be extracted and added to a company's portfolio of assets, subject to the annual reporting cycle, and the economic context. The research provider was selected as having the most complete dataset available.

To build on the previous global analysis we also considered resources with less certainty of feasible extraction and economic viability. It was important to at least highlight the existence and scale of these resources as the capital investment strategies of these companies are directed towards developing them.

Carbon dioxide emissions factors

The formula for calculating the carbon emissions from the reserves was taken from the methodology used by the Potsdam Institute in calculating the global carbon budget. This estimates potential emissions from proven recoverable reserves of fossil fuels, according to $E = R \times V \times C \times f$, where E are the potential emissions (GtCO₂), R the proven recoverable reserves (Gg), V the net calorific value (TJ/Gg), C the carbon content (tC/TJ) and f a conversion factor (GtCO₂/tC).³³ V and C come from the IPCC Guidelines for National Greenhouse Gas Emissions Inventories.³⁴ The Potsdam methodology applies CO₂-only factors to the fuels, as IPCC factors for all the Kyoto gases to give CO₂-equivalent (CO₂e) are specific to the use of the fuels.

In order to compare the CO₂ potential with the South African Carbon budget debate (which is conducted in carbon dioxide equivalent (CO₂e) for the full suite of six greenhouse gases), we required a factor to convert the data. We used a country specific factor from the South African government which reflects the approach taken for the national GHG inventory.³⁵

Reserves classification

The coal reserves were split into bituminous/anthracite and sub-bituminous classes, again mirroring the Potsdam Institute methodology. These types correspond with the data tables for the elements which make up the carbon emissions formula. Not all coal assets in the RMG database indicate the type of coal in the mine. Where this data was not available it was assumed the coal was bituminous coal, the most common type.

Equity basis

Reserves, and therefore potential emissions, were attributed to each company on an equity ownership basis.

Allocation to stock exchanges

For this national analysis, the reserves were attributed to the company in their entirety, as investors would have exposure to the full risk of the company. However, many companies also have listings on other markets so it is not only through the Johannesburg Stock Exchange that investors may be exposed to these corporations.

Financial data point

The analysis was conducted using financial data for the end of Q1 2012. The composition of the ASX Top 200, and GEPP's portfolio, and the market capitalization of the companies included were taken at this date. Relative weightings and stock prices will obviously change continuously, and new stocks will list and others de-list, which will impact the constituents.

Data accuracy

The approach taken is based on the best available data and provides a conservative estimate of the total reserves and potential resulting emissions attributable to listed entities and their associated stock exchanges. We rely on third parties for the reserves and resources data. We believe the dataset to be of sufficient quality to test the overall hypothesis that there is sufficient carbon listed to use up the South African carbon budget 2010 to 2050 and give a reasonable representation of the exposure of listed entities. We welcome comments on how to improve the analysis and suggestions of useful outputs for future research.

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