

The Destruction of the Highveld

Part 2: Burning Coal



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The groundWork Report 2017

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Acronyms

AER	Atmospheric Emissions Licence
APPA	Atmospheric Pollution Prevention Act of 1965
AQA	Air Quality Act of 2004
AQMP	Air Quality Management Plan
BEE	Black Economic Empowerment
BIG	Basic Income Grant
BLIPP	Coal Base Load Independent Power Producer
BTEX	Benzene, Toluene, Ethyl benzene and Xylene
CAPCO	Chief Air Pollution Control Officer
CO₂	Carbon dioxide
DEA	Department of Environmental Affairs
DoE	Department of Energy
DTI	Department of Trade and Industry
ESP	Electrostatic Precipitator
FFP	Fabric Filter Plant
FGD	Flue Gas Desulphurisation
Gt	Gigatonne (a million tonnes)
HPA	Highveld Priority Area
IPCC	International Panel on Climate Change
IRP	Integrated Resource Plan
LNB	Low NO _x Burners
MEC	Minerals-Energy Complex
MES	Minimum Emission Standards
MI	Megalitre (a million litres)
MW	Megawatt
PM₁₀	Coarse particulates
PM_{2.5}	Fine particulates
PV	Photovoltaic
NO_x	Oxides of nitrogen
O₃	Ozone
RE	Renewable Energy
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
SO₂	Sulphur dioxide
TB	Tuberculosis
VOC	Volatile Organic Compounds



Foreword

We need to understand and speak with the periphery of the periphery. –
Dr Patrick Maesela, Member of the Portfolio Committee on Health, 8th
September 2017.

On the 8th of September 2017, for the first time ever, community people from the coalfields of South Africa spoke with those in political leadership tasked with ensuring that people live healthy lives in South Africa. To their credit, members of the portfolio committees on health and environment came to a meeting with community people to hear evidence of how Eskom's coal-fired power stations are responsible for more than 2 200 deaths a year and how it is impacting upon the country to the tune of R30 billion a year. The meeting was shunned by the portfolio committees on economic development, energy, mineral resources, water and agriculture.

At this gathering we were urged to listen to those who are the poorest, as the creation of wealth for a few also produces poverty for many. Listening to those made poor is critical. Having open and honest conversations with people on the periphery in Mpumalanga is what this report seeks to feed into.

It is also important how *The groundWork Reports* speak to the urgent issues of the day. Last year's report was *The Destruction of the Highveld Part 1: Digging Coal*. Together with reports and investigations by the Centre for Applied Legal Studies, the Centre for Environmental Rights and the South African Human Rights Commission, it spoke to the true nature of coal mining. It showed that there has to be a community-led dialogue on life after coal because governance is failing, the brutality of mining is evident and the promises of wealth for people are false. The groundWork Reports are also known as the



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State of Environmental Justice Reports and, since our first report on Corporate Accountability back in 2002, we pride ourselves on taking up the thorny issues of the day.

This year's is no different. In 2015 we put detailed thought into the decision to focus on coal on the Highveld. In the last two years, Eskom and the colliers have been in the news regularly. The violent extraction of resources by the political and corporate elite has been juxtaposed with the impoverishment of the majority of South Africans. This report focuses on the burning of coal and it comes out as a time when various reports by government and NGOs show that air pollution governance is failing in Mpumalanga and other hotspots in South Africa.

It is clear from Part 1 that the mining houses have taken good land and have left a barren mess. This report shows how the coal burning industries on the Highveld have a toxic impact on people. People have no choice but to breathe. And they have no choice but to take on dangerous and toxic work – if they can get it. In the world made by coal, metals, chemicals and electric power, government has failed to deliver on the promises made in the Freedom Charter and the Constitution.

It is abundantly clear that coal is not pulling people out of poverty. Capitalism is now destroying work. The heyday of the labour intensive industrial revolution – with mass employment, pollution and ill health – is over. We are now entering the era of automated extraction, mass pollution and mass ill health – yes, we have kept those. And the solution to this is not technical, but political, where people understand what coal does to their lands and bodies and then work through the question of what life after coal is. There is no quick fix, despite the desperation of that need. Life after coal is about the social justice slogan 'another world is necessary'. It is going to be a long road that demands some of us to give more than we take. It demands a just transition that calls for democratic and patient processes, that includes all and not only the elite. It demands justice for, as long as there is "injustice somewhere, there can't be



peace anywhere”¹ The coal economy is violent. It causes conflict. Peace is nowhere to be found in the coalfields of South Africa.

As you will read, there is much evidence that the world is in chaos. The planetary system that we rely on for survival is becoming extremely dangerous as it responds to the violence of extraction. Since this publication went for final editing and layout, hurricane after hurricane has devastated several Caribbean islands and parts of the United States. Sadly, as environmental justice writers we are often thought of as doomsayers, but we cannot keep up with the catastrophic impacts of climate change. Global leaders are again getting ready to hold another ‘Conference of the Parties’ (CoP) on climate change. But this is a leadership that will not take the bold decisions that are needed to secure a just transition to a changed economic and political system.

We now have much evidence on the situation in South Africa to show that coal is killing us. As I write this, *Bliss of Ignorance*, a groundWork documentary on the devastation of coal, has won another award, this time for Best South African Short Documentary at the Jozi Film Festival. We have South African focused health research that points to the fact that air pollution is killing people. We have government admitting that air quality management has not delivered any improvement in air quality and hence has done nothing to protect people. We need to act now, for tomorrow is too late. We need to embark on a ‘path of struggle’ that ensures that workers and community people on the periphery of the social and economic system created by the minerals-energy complex are making the decisions that shape their future world.

Bobby Peek
Director
groundWork

1 Thuli Madonsela, City Press, 24th September 2017.



Foreword



Burning Coal – A brief introduction

Coal is dug to be burnt. Whereas Part 1 of *The Destruction of the Highveld* [2016] focused on the politics and impacts of mining coal, Part 2 focuses on the burning of coal: on the power stations, petrochemical and metallurgical plants that burn it, the massive amounts of pollutants released into the Highveld air, the impacts on people who live there, the fights for clean air by communities and activists, and the slow and partial responses to this growing environmental health crisis by a reluctant regulator.

Nowhere is it as clear as in the atmosphere how the planet's elite destroys the resource base we all depend on. On the Mpumalanga Highveld, the burning of coal has enclosed the commons of atmosphere, making it a dirty industrial drain in the sky. An essential element of life – air to breathe – has been enclosed, and there is no alternative for people who live in the Highveld but to breathe in these pollutants and watch the environments they live and work in deteriorate.

This carelessly created dirty air imposes extensive externalities on the people who live on the Highveld. It affects people's health in almost all body systems: lungs, heart and circulation, nervous system and reproductive systems. It imposes disease, shortens lives, and reduces the ability to work, find work or just perform daily activities. It is clear to people who live on the Highveld that, on a daily basis and in their own bodies and often meagre budgets, they carry the burden of South Africa's coal-based electricity and industrial systems.

People have for decades been deliberately excluded from decision making about whether to burn coal at all on the Highveld. Under colonialism and apartheid, black South Africans were deliberately put in the way of pollution: at work and at home, as is evident in the experiences of both workers in the dirty industrial area of Ferrobank and residents next to it in Ackerville,



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eMalahleni, recorded in this report. With cruel irony, environmental racism located the region's TB hospital for black people in this area.

To understand this exclusion from decision making, we point to a specific type of knowledge of air pollution that developed under apartheid but survives to this day. At least six decades ago, scientists pointed out that the Highveld was a particularly bad place to burn coal because of the dynamics of the atmosphere. However, this did not lead to excluding coal burning industry from the area, but its opposite – a massive increase of coal-fired power stations, the location of Sasol 2 and 3 on this coalfield, and a complex of metal industries consolidated by Anglo American.

Research on pollution was overwhelmingly funded by the big polluters, who also held a near monopoly of monitoring information. Its focus was to make the burning of coal possible – finding ways around the 'unfavourable meteorology' or 'low pollution dispersal potential' of the Highveld – and not to encourage reasonable decision making about whether coal burning enterprises should be established there. A neglect of health research – and the absence of any programmes to soften the impacts on the Highveld communities – has kept the real costs of externalities imposed on the Highveld out of focus and decision making. This was the intellectual and bureaucratic equivalent of a system of medical professionals that denied and obscured the health impacts in the workplace, as we heard from many workers and trade unions. Research also delayed the recognition of acid deposition, and with it the need for stricter control of sulphur dioxide and nitrogen oxide pollution.

The powerful, profit-based decisions that have turned the Highveld sky into a drain for industrial pollutants are traced in the histories of three groups of coal-burning industries in this report.

Eskom, the state-owned utility that produces 90% of its electricity from coal, has concentrated 12 of its 15 coal-fired power stations on the Highveld, and produced cheap and dirty electricity that has driven the extractive logic of the minerals-energy complex (MEC). It has functioned as a law unto itself for most of its existence. And, when activists finally succeeded in moving the regulator – the Department of Environmental Affairs – to set minimum emission standards for the first time, Eskom argued that the benefits of the



new standards were ‘negligible’, and that it knew best what pollution control to apply and not to apply. It applied for and received ‘postponements’ – with the implication that ‘rolling postponements’ could be turned into effective exemptions – from complying with the new standards.

Sasol, the dirty coal- and gas-to-liquid fuel apartheid parastatal, was fattened by state subsidies and windfall profits, privatised in 1979 and turned itself into a transnational energy corporation after apartheid. It too managed to negotiate non-compliance with the new emission standards, leaving air quality regulation hollow.

Metal industries – steel and ferrometals – have developed on the Highveld since the 1960s as a complex of undertakings driven largely by Anglo American’s investments. This complex has since disintegrated and passed into the hands of Russian oligarchs and ‘business rescuers’, who have dumped both workers and environmental legacies. The huge mountain of vanadium and other waste in Ferrobank, next to the still burning Transvaal and Delagoa Bay colliery, stands as a symbol of corporate carelessness.

The destruction of the Highveld’s atmosphere would however not have been possible without the lax regulation by the state, which from the start has been reluctant to impose a regulatory ‘burden’ on coal-burning industries. It has continued the MEC tradition of a state that subsidises corporate profit by allowing the externalisation of environmental and health costs onto society.

Environmental activists have used the freedoms of a hard won democracy to push the regulator into replacing the failed apartheid era Atmospheric Pollution Prevention Act (APPA) regime with a new approach based on the environmental right in the Constitution. Standards for ambient air quality have been set, hotspot areas created by decades of pollution have been identified, and investments have been made by the state in new monitoring and research. But none of these can remove the fundamental unsustainability of building a future on the dirtiest of fossil fuels: coal.

We again – as in Part 1 – point to the urgency of a just transition from fossil fuels to socially owned renewable energy. Such a transition needs to be based in solidarity: a solidarity that keeps the inhabitants of our planet



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from plummeting into disastrous climate change, a solidarity that refuses a world of cynical power and profit seeking, but instead rebuilds ecosystems and flourishing societies. In the meantime, we need to expose and resist the desperate efforts of a dying MEC to reboot itself, amid false promises of jobs and prosperity resulting from its destructive enterprises.

groundWork reports are the result of the collective work, knowledge and insights of many people. This report, like the previous one, has been produced with the participation of the Highveld Environmental Justice Network (HEJN), an alliance of community-based activists on the fencelines of coal mining and coal industries. HEJN activists took us around on the Highveld. groundWork and the Centre for Environmental Rights (CER) have been in the forefront of air quality struggles, and this report relies on many years of their work and knowledge. We thank the comrades from Numsa who gave freely of their time and knowledge, the researchers who were willing to share their knowledge with us (we did encounter a few refusals), and officials from the DEA who spoke to us. We also learnt from comrades in the broader environmental justice movement. We would specifically like to thank Thomas Mnguni, Nomcebo Makhubelo, Elizabeth Malibe, Nombulelo Shange and Robby Makgalakala who formed the research team on the Highveld field trip and shared their observations and insights with us. Jan Sibiya, George Jacobs, Christina and Daniel Skhosana, Mrs Mthimunye and her granddaughter Ntombizodwa, Emily Buhali, Freddie Maroos, Anna Bruiners, Dorothy Sibanyoni and Peter Sibanyoni, Andrew Mokone, Khehla Mahlangu, Lucky Cindi, Elias Makubo, David Mahlangu and Amos Mnisi live on the fenceline of polluting industry and shared their experiences with us. Numsa shop stewards and officials shared the experience of working inside of those industries. They were Jabulani Makathini, Sello Mokoana, Peter Tau, Vusi Mnisi, Judas Mokgabudi, Pascal Mabuza, David Mapahanga, Lucas Mahlangu, Nthabiseng Shabangu, Mzwandile Mangali, Poppie Ndlela and Sam Lukhuleni. And we benefitted from the insight of many others who shared their knowledge with us including Bobby Peek, Rico Euripidou, Robyn Hugo, Melissa Fourie, Nicole Loser, Jackie Cock, Steve Faulkner, Eugene Cairncross, Lucian Burger, Peter Lukey, Rebecca Garland, Mogesh Naidoo, Jesse Burton, Prakashnee Govender and the DEA's Thuli Khumalo, Patience Gwaze, and Vumile Senene.



1

Nowhere to run to

The volume of hot exhaust gas blasted from industrial stacks on the Highveld is astounding. Eskom's Duvha power station burns about 46 000 tonnes of coal a day and pumps out 8.4 million cubic metres per hour (m³/h) from its two stacks. That's over 200 billion litres of dirty gas per day. It blasts from the stack at a temperature of 150°C and a speed of 82 km/h. The older plants burn less coal but push out more gas per tonne. Hendrina burns 27 000 tonnes a day and puts 7 million m³/h exhaust gas into the air.

What's in the exhaust is also shocking. Eskom has 11 coal power stations on the Mpumalanga Highveld. When they are working at full capacity, they produce about 195 million tonnes of carbon dioxide (CO₂) a year, 1 346 466 tonnes of sulphur dioxide (SO₂), 814 869 tonnes of nitrogen oxides (NO_x) and 86 002 tonnes of particulates (PM₁₀).¹ The new Kusile power station makes 12. It is still under construction outside eMalahleni and will add to the emissions count.

At Sasol's plant in Secunda, the two main stacks blast out 22.4 million m³/h of gas at 185°C and up to 100 km/h. The plant has eight more stacks which pump out another 1.3 million m³/h. The ten stacks together thrust 568 billion litres of exhaust gas into the air every day, according to an Atmospheric Impact Report commissioned by Sasol [Burger et al 2014]. In addition, several flares, designed to incinerate off-gases and surplus gases produced during upsets, burn constantly.

¹ Emission volumes from power station Atmospheric Emission Licences; annual emissions from Eskom application for postponement of minimum emission standards reported in Myllyvirta 2014.



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Sasol reports global emissions but, since about 2005, has refused to account for local emissions.² The Secunda plant is generally acknowledged as the largest single point source of CO₂ in the world. In 2004 emissions were 52 mt/y CO₂ [Hallowes 2011: 184] and have certainly increased since. The 2011 Highveld Priority Area Air Quality Management Plan (HPA AQMP) indicates that it produces 190 172 tonnes of SO₂ a year, 148 434 tonnes of NO_x and 8 246 tonnes of PM₁₀ [DEA 2011].³ These figures were probably already dated in 2011 and it is doubtful that they capture the effects of major expansions underway at Secunda since 2007.

Sasol also emits a cocktail of volatile organic compounds (VOCs) most of which are toxic. Some of these are fugitive emissions as they leak out of pipes, drains, valves and pumps and evaporate off tanks, tar pits and waste water dams. Sasol now reports an 'indicator of performance' – which shows little improvement – but 2004 VOC emissions at Secunda were put at 409 783 t/y. Nearly half of that is methane which is dangerous to health at ground level and a potent greenhouse gas as it rises into the atmosphere. It is enough to add another 7 million tonnes to Sasol's annual greenhouse gas count.⁴ Sasol monitors show 'elevated concentrations' of benzene on the Secunda fenceline particularly in winter [Burger et al 2014: 69]. Benzene is typically emitted as part of the BTEX complex (benzene, toluene, ethylbenzene and xylene) and, at Secunda, the complex of plants gives rise to many other VOCs.

For Eskom, as well as Sasol, fugitive emissions also come in dust blown off ash dumps, coal stock yards, conveyor belts, and from the copious amounts of dust kicked up by heavy vehicles – particularly coal trucks.

'Dust' is most strongly associated with the big metal smelters in Middelburg and eMalahleni. This is because of the very high levels of particulate emissions

2 We asked them for updated figures on 31 May 2017. They said they would let us know. We are still waiting.

3 The AQMP is coy about naming polluters but gives figures for the 'petrochemical sector', that is, Sasol.

4 In the Fifth Assessment Report, the IPCC increased its estimate of the potency of methane as a greenhouse gas. It said methane has up 34 times the global warming potential of CO₂ over a 100 year period. The previous estimate was 25 times. Over a 20 year period, it is 86 times more powerful, up from the previous estimate of 72. See Joe Romm, *More Bad News For Fracking: IPCC Warns Methane Traps Much More Heat Than We Thought*, ThinkProgress, 2 October 2013.



from furnaces as well as the dust from slag heaps and waste dumps. Particulates from all sources are likely to contain toxic heavy metals. Fine particulates produced by the furnaces are most dangerous as they penetrate deep into people's lungs and then into their blood.

Typically, such emissions are at or near ground level. Industrial Middelburg is dominated by Samancor Ferrochrome and Columbus Steel. In eMalahleni, the big plants include Samancor Ferrometals, Highveld Steel and Vanadium, Vanchem, Transalloys and Union Carbide. At all these plants, the stacks taking exhaust gases from kilns, furnaces and ovens are very low – barely rising above the height of the buildings. According to the 2011 HPA AQMP, 'primary metallurgical' industries on the Highveld emit 39 582 tonnes of SO₂ a year, 4 416 tonnes of NO_x, and a massive 46 805 tonnes of particulates. It does not give a breakdown for each plant and does not even list the primary metallurgical plants. For the most part, the big smelters had not measured emissions⁵ – making the AQMP figures somewhat uncertain.

As described in Part 1 of this report, the coal mines are also major sources of dust emissions as well as ground level emissions from the fires on mines and discard dumps. Additional sources include 'secondary metallurgical' industries, brick making, domestic coal fires and traffic – this last being a major source of NO_x particularly from diesel trucks.

All told, according to the AQMP, 1 633 655 tonnes SO₂, 978 781 tonnes NO_x and 279 630 tonnes particulates are dumped into the air of the Highveld each year. This is likely severely underestimated. Thus, the AQMP under-reports power generation (Eskom) PM₁₀ emissions by more than half and NO_x emissions by more than 10%.⁶

Air pollution has a heavy impact on people's health. Between 2 200 and 2 700 premature deaths, including 200 children, are attributable to Eskom's

5 See Appendix 6 of the HPA AQMP.

6 AQMP gives 34 kt/y PM₁₀. Eskom's Annual Reports give a low of 72 kt in 2012 and a high of 82 kt in 2015 for the full fleet. This implies between 56 and 64 kt for the Highveld stations. In 2013, however, Eskom applied to the DEA for an exemption (later, postponement) from minimum emission standards and its 'emission reduction plan' gave much higher readings: 100 kt for all stations and 86 kt for the Highveld stations as reported above.



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coal burning power stations every year, according to Lauri Myllyvirta [2014: 14]. About 1 400 of those ‘equivalent attributable deaths’ result from the 11 Highveld power stations. They come at the end of a longer or shorter period of debilitating illness from lung diseases, including lung cancer, heart disease and strokes.

Box 1: Equivalent attributable deaths

‘Equivalent attributable deaths’ is a rather technical, but precise, concept in the language of epidemiology intended to make the invisible visible. Holland notes that a simple “reference to ‘deaths’ might imply that a number of specific individuals, and only those individuals, are affected, and perhaps even that those individuals would be traceable”. However, “air pollution acts alongside” a number of other stressors such as “smoking, diet or lack of proper exercise”. ‘Equivalent attributable deaths’ separates out the burden of air pollution. Air pollution is thus a contributing factor in the early deaths of a much larger number of people.

Tens of thousands more people are afflicted with asthma and bronchitis. Thousands are, or should be, admitted to hospital, many more suffer ‘restricted activity days’ – days when they cannot function normally – and every year about a million working days are lost [Holland 2017: 15]. The cost to society of Eskom’s national fleet adds up to over R30 billion a year with the Highveld stations contributing over R20 billion of that.⁷

Mike Holland emphasises that “air pollution most affects those whose underlying health condition is worst”, and hence that “any improvement in air quality will most benefit those who are most disadvantaged” [2017: 17]. Indeed, a large portion of the ‘costs to society’ is imposed on workers and poor communities on the industrial fenceline since neither industry nor the state picks up the tab. And air pollution adds another layer of vulnerability to

⁷ Myllyvirta estimates national costs from deaths only at “30 billion Rand per year” [15]. Holland estimates costs from death and illness at \$int 2.373 billion which we convert at R14/\$ to give R33 billion. About R3 billion of that is from illness.



people whose health is already compromised by poor nutrition – associated with diabetes and obesity – and by the high incidence of TB and HIV Aids.

Fires, explosions and leaks

Reported emissions, and hence calculated impacts, are from ‘normal’ operations only. Big industry in South Africa is notorious for producing big incidents – explosions, fires and leaks. And there are many smaller incidents. All plant emissions increase when something goes wrong to create ‘upset conditions’. Instability with increased emissions is also created when the plant is shutting down for maintenance and again when it starts up. Maximum emissions are then supposed to be reported. At Secunda, this cannot be done as emissions go off the dial – exceeding what the instruments can measure [Burger et al 2014: 32].

In the five years to 2016, Sasol reports over 60 ‘significant fires, explosions and releases’. In the previous five years to 2011, it reported 200 such incidents.⁸ This, however, does not show an improving trend. Less than 30 incidents per year are recorded in 2007 and 2008 and again in 2015 and 2016. The years in between show much higher numbers spiking at 63 in 2010. Over the ten years, 51 workers were killed.

Not many of these incidents make it into the media. A sampling of Secunda incidents that did include:

- 12 May 2017: Gas leaks from a ruptured pipe. The gas did not ignite but Sasol closed all entrances to the plant. Two workers had to be treated at Sasol’s medical centre. Sasol said: “There is no immediate risk to the community and Sasol remains committed to the safety of its employees, service providers and the community.” This kind of statement – by both corporations and authorities – is pretty much routine. Whether or not there is any basis for saying so, Sasol invariably denies that there is any impact on the community.

8 Sasol Sustainable Development Reports (SDRs) 2016 and 2011.



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- 8 October 2014: Fire breaks out at the Synthol plant and 23 workers were treated for smoke inhalation.
- 24 August 2011: An explosion is followed by fire at the gasification plant. One worker was injured. Sasol said: “The safety of our employees, service providers and community remains our top priority.” It said that the fire did not affect the community.
- 11 March 2009: Fire breaks out at Sasol tank farm. Three workers are hospitalised and one dies.
- 1 September 2004: Leaking gas explodes at Sasol Polymers ethylene plant. Ten workers were killed and over 360 injured. Some workers believe that many more people were affected, on and off Sasol’s site, and the true impact of this incident has been concealed. The then minister of labour said that if Sasol killed any more people he would shut them down. They did. He didn’t.
- 21 June 2004 (just two months earlier): A tank explodes at Secunda, killing one worker. Unions and Sasol’s occupational safety officers point to lax safety management and warn that ‘the big bang is still to come’ – as it did in September.⁹

Following the September 2004 incident, Sasol announced a makeover of its safety training programme and safety ‘culture’ including “contractor management standards”.¹⁰ What it did not address, however, was the practice of outsourcing work to contractors in the first place. As the 2006 groundWork Report observed, contracting out is used to “cut costs and limit liabilities” and “results in the long term erosion of institutional memory and intimate knowledge of complex plants” [37].

Poor maintenance at Eskom has also led to a spate of incidents. Amongst others:

9 Mathabo le Roux and Marida Fitzpatrick, *Sasol ‘was warned’*, Fin24, 3 September 2004. See also http://www.klasslooch.com/sasol_gas_leak_jan_05 for an archive of news stories on a Department of Labour inquiry into the September blast.

10 Sasol Sustainable Development Report 2005: 45.



- 26 November 2014: The ash system at Lethabo, in the Vaal Triangle, breaks down and dumps tonnes of toxic ash over workers inside the plant and over the community on the outside.
- 1 November 2014: The central coal silo at Majuba collapses in a cloud of coal dust.
- 30 March 2014: Duvha unit three boiler explodes. The boiler itself was destroyed. It split open and its entrails of high pressure piping collapsed in a twisted heap. Holes were blown through the roof and walls of the boiler house. Unit three is still to be repaired. Eskom says it will be back in operation only in 2020¹¹ but even that seems doubtful.
- 9 February 2011: Duvha unit four turbine spins out of control and shatters. Bits of broken metal shrapnel shower the building and one piece rips through the turbine hall roof. Fortunately, no-one was hit. Repairs to unit four took two years.

Eskom is also devoted to outsourcing, in part to facilitate business opportunities purportedly for BEE companies. It is also diversifying – or rather, fragmenting – the coal supply, using coal from the small mines of small companies in place of the big old mines of the major corporations. In part, this is because the big mines are depleted. In part, it is to hand contracts to those in political favour. Power stations are designed for particular coal qualities and uniformity is harder to manage in these circumstances. This is the more so as quality monitoring gets rigged to favour or exclude particular miners. The introduction of different coal, and the failure to adjust the plant to handle it, is thought to be one reason for the Duvha boiler explosion.¹²

The fragmentation of supply also means that more coal is being trucked in to the power stations and less is put on the conveyor belts from tied mines. As noted in Part 1 of this report, there are 1 500 coal trucks on the road to Eskom every day. The drivers get a small basic wage but are mainly paid per load delivered. Hence, they keep long hours and are under pressure to speed. In 2016, Eskom reported one “contractor fatality and 13 public fatalities related

11 Eskom Integrated Report 2016: 49.

12 Ivo Vegter, *Eskom's problems are of its own making*, Daily Maverick, 9 February 2016.



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to the road transport”.¹³ In addition, the roads are breaking up under the load of coal trucks and so making for more hazardous driving irrespective of whether a coal truck is approaching at speed or not.

There is scant information available on incidents in the metal industries of the Highveld. Few of the companies are publicly listed and those that are do not give a full account of incidents or environmental transgressions. Some transnational corporations like Glencore give global statistics with no local details except where there is major loss of life. Others, like Luxembourg-registered Duferco, which owns Vanchem, report nothing at all. Merafe, Glencore’s local BEE partner, is the only company that gives any account but it does so very selectively.¹⁴

Workers note that furnace incidents produce high levels of pollution. A Basic Oxygen Furnace (BOF) is ‘charged’ from the top with coking coal and ore. If it’s not done right, part of the charge can get stuck and then ‘slip’ suddenly down the furnace, creating upset conditions and heavy particulate emissions. In Submerged Arc Furnaces (SAF), where the energy is provided by massive electrodes, explosions can warp the vessel and cause a ‘breakout’ – spilling molten metal across the factory floor. SAFs are powered by large amounts of electricity and electrical explosions are not uncommon and can be deadly. Recent incidents in eMalahleni include:

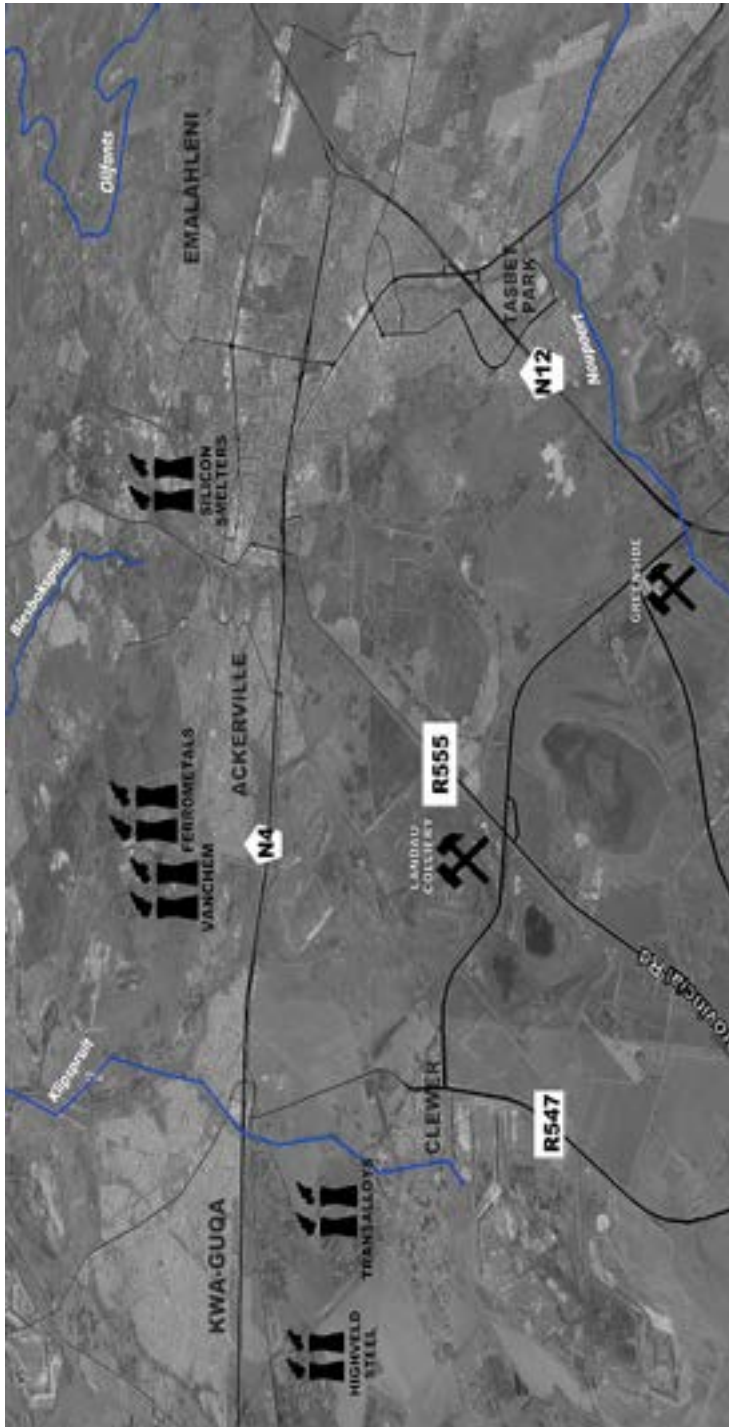
- 7 October 2016: Ferrometals high voltage transformer bursts into flame.
- 19 May 2015: Silicon Smelters furnace transformer explodes and burns for seven hours.

13 Eskom Annual Report 2016: 46.

14 See the Centre for Environmental Rights 2016 Full Disclosure report on corporate accountability: <https://fulldisclosure.cer.org.za/company/merafe-resources-limited>



Map 1: eMalahleeni



Nowhere to run to

Metal in the hood

Ackerville is located just below the Ferrobank industrial area in eMalahleni. The hilltop above them is dominated by two massive plants: Samancor's Ferrometals and Duferco's Vanchem. Behind them are several smaller facilities including Glencore's 'Carbon Division' and a large Engen petroleum depot and a Coca-Cola plant that proudly displays its partnership with Shanduka. Ferrometals is "the largest single ferrochrome producer in the western world" according to the company website.

Vanchem is a rusty and dusty plant that produces vanadium. Workers say it looks ramshackle because vanadium is extremely corrosive and cladding, conveyors and pipes are constantly being replaced. Alongside it is a large slag heap with water pooled in a depression at the top. At the bottom, water seeps out and gathers in a ditch lined with white salts. This black hill of waste overlooks the Transvaal and Delagoa Bay (T&DB) coal mine, abandoned and burning underground for 70 years. A little way off from the fires, mine services company Benicon has restarted active mining within the last year – just a couple of hundred metres from Ackerville. Across the N4 freeway, is Transalloys and Highveld Steel crowns the hill about 10 km up the freeway. Close to the centre of town is Silicon Smelters, formerly known as Rand Carbide.

The Witbank TB hospital is right next door to Ferrometals. The hospital was established by the South African National Tuberculosis Association (SANTA) in 1955 to respond to the high incidence of TB among 'non-Europeans' in Witbank. It was put there because the apartheid authorities would not allow it anywhere else. Singer comments that the "hospital was a place of refuge for terminally ill patients, but this was compromised by its proximity to industry. Depending on weather conditions, smoke and airborne chemicals floated around the local atmosphere, often landing up in the airways of those who could least afford it" [2011: 66].

The hospital is now to be moved to a less polluted place in Middelburg. But this will remove a facility that serves many local people. Besides, Middelburg is also surrounded by coal mines. Columbus Steel and Samancor Ferrochrome dominate the industrial skyline. Next to Ferrochrome is Calmasil which



produces agricultural lime. Both are covered in dust – black for Ferrochrome, white for Calmasil. The ‘coloured’ suburb of Nazareth is just across the road. At a local centre for the elderly, people say you can’t see the dust from Columbus but, on particular days, you can smell it. The old people have sinus problems and incessant coughing. Some suffer from lung diseases. Some fight to breathe when they come to the centre.

In Ackerville, people say that the worst time of the year is August when it is dry and windy. “Depending on the wind, sometimes the dust is from Ferrometals, sometimes it is from Transalloys,” says George Jacobs. Others say the dust just comes from everywhere. The nights are worse than days. Everyone sleeps with their windows closed but it gets in anyway. In the morning they sweep black dust from their verandas and paving. Emily Buhali cannot manage that. Sweeping raises the dust and instantly triggers a range of symptoms – burning eyes, inflamed sinuses and headaches. The dust also gets into the house and gathers on the curtains which she has to wash frequently. But then, as all the women say, you can’t hang out the washing.

Vanchem closed down on the 26th of January 2016. This made a small difference but the wind still blows dust from the slag heap and from the site itself. The dust from Vanchem is particularly aggressive. “We have seen workers in Vanchem bleeding from their noses. They get transferred from Vanchem to Transalloys and there the bleeding stops,” says Jan Sibiya. He used to work at Transalloys and is now retired. Christina Skosana recognises the Vanchem dust because it’s black and shiny. She cannot sleep when the wind blows it in at night. For Buhali, on the other hand, Ferrometals is the problem. The mine, opened on the old T&DB site, adds a new dimension as blasting kicks up clouds of dust and houses crack. Jacobs says, “The blasting is terrible. The earth shakes like an earthquake has hit us.”

A former worker who was responsible for the wet scrubber for dust (particulate emissions) at Vanchem until 2010, said that the unit was leaky and fumes and dust constantly escaped from it. Moreover, the scrubber “broke down almost every day”. It was then switched off at night so that maintenance staff could try and fix it. But the production plant was not switched off. This confirms the



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Map 2: Middelburg



suspicion of many in Ackerville that pollution is worse at night because the big factories switch off their pollution control equipment under cover of darkness.

Even if air quality is ‘managed’ according to ‘best practice’ – which it is not – pollution limits are guided more by what is practical for industry than by what would protect people. Particularly vulnerable people. Children are more vulnerable than adults. Sibiya has his grandchildren living with him and they are frequently sick with asthma, bronchitis and sinusitis. Mthombizodwa Mthimunye’s daughter is 10 and has had a skin rash that’s been coming and going since she was six. It sometimes gets so bad she can’t go to school. The doctors say it is caused by pollution.

Mthimunye’s father worked for Highveld Steel and her parents moved into company housing in Ackerville in 1980. When he died, her mother had to move out and they came to this house. Her sister died because of asthma which turned into pneumonia. She was in her early 30s. “She also had a skin problem like my child. I grew up in this house and now my children are growing up here too.” Her uncle also lived with them. He suffered for many years from TB and died in 2008. He was treated at the TB hospital and the doctors there said



it was caused by the 'dust'. The hospital also provided TB vaccinations for the family.

Many people in Ackerville are 'on oxygen'. Jacobs bought an air purifier because his wife has breathing problems, especially at night, and it helps her sleep. Mthimunye notes that purifiers, nebulisers and other such machines need electricity. eMalahleni, however, was behind in its payments to Eskom and, in early 2017, the utility imposed a schedule of power cuts on the entire municipality. People note the irony that Duvha, one of Eskom's largest power stations and a big polluter, is just across town. Four other stations, Kriel, Matla, Kendal and Kusile, are within the municipal boundaries and Arnot and Hendrina are just to the west in Steve Tshwete municipality. Kendal has the highest emissions of all the Highveld power stations. Kusile is still under construction but has two units running. It will be the first Eskom plant built with a sulphur scrubber.

Mthimunye makes good use of the local clinic. They are testing her daughter, who has been coughing for a month, for TB – so far with inconclusive results. They also do homecare visits and she thinks the clinic is doing a good job. Others have a less positive experience. Sibiyi says, "The clinic has nothing to help you with. They give you Panado for everything." Many people end up going to private doctors when they don't get better on the clinic's treatment.

This gives rise to another form of inequality. Those with medical aid are better off than those without. And so are their children. Sometimes, children may be claimed by an uncle or an aunt who has medical aid so as to get them treated. Otherwise, people go to the doctor when they can pay cash. Then they may get a prescription but not have the money to buy the drugs.

People say that they talk to their councillors about air pollution, mostly at ward committee meetings, but they take no action. Councillors promise to talk to the corporations but they always come back with the same story: "We must not blame the Ferrobank industries. Be patient, things will improve." The councillors prefer to divert attention to other issues: the removal of the TB hospital and the replacement of asbestos roofs. The corporations also have phone numbers on their signs. But, people say, they are put on hold until their



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air time runs out. Buhali sums it up: “There is nowhere to complain to. Neither government nor industry takes responsibility.”

Metal work

Highveld Steel is just across the N4 from KwaGuqa Section 14. It was closed down on the 10th of February 2016 and the air cleared instantly. “You could walk outside on your lawn and see how quickly the black dust from that factory covered your shoes,” says one resident. Workers say pollution monitoring was done by camera which only worked in the light of day. At night, the plant managers opened the stacks and switched off the scrubbers to save on costs.

The workers get a double dose, at work and at home. Nthabiseng Shabangu worked at the Highveld Steel plant and used to live in Section 14. People there suffer constant nose bleeds – particularly the children. “When we visit family in Limpopo, you can feel that you are breathing a different air. And the children’s nose bleeds stop.” She moved to Tasbet Park, about 20 km away, to escape the pollution from her workplace. The air was a little cleaner but they were closer to Anglo’s Greenside and Landau coal mines on the edge of town. So now they have the dust and cracks from blasting. They are also closer to Duvha power station. In eMalahleni, she says, there is nowhere to run to.

The workers do not expect their children to get the ‘red ticket’ – the medical certificate required for people to get a job in Mpumalanga’s heavy industries – because they have grown up with the pollution from those industries. Shabangu observes that many of those who have found work there, men or women, do not make babies. She herself became pregnant only after Highveld was shut down. So now she has a child but has lost the means of supporting her family.

At work in the smelters, the environment is extreme. At Vanchem, say the workers, the risks are well known. “When you work there you get smaller – your body shrinks. Your face changes. You feel tension in your body. Nobody can work there for longer than 20 years and not die. The main damage is to the kidneys and lungs. They give us milk every day.” The milk ration is meant



to prevent vanadium poisoning but it probably works better to prevent discomfort to the conscience of managers.

Workers say that they are exposed to high temperatures and fumes off the molten metal at three points in Vanchem's production process: at the primary furnaces and kilns; during tapping from the ladles; and at the fusion furnace. The heat is extreme and they have to wear full breathing masks. In 2014, workers went on strike and won payment of a risk premium for working in those areas.

Heat and dust is the common lot of workers at the smelters. Production continues night and day. Workers at Ferrometals say chrome dust is thick in the air at the pelletising and sintering plants. Many of them end up with TB, which is associated with that dust. Sintering turns the material into something like a cinder. This material is pre-heated and mixed with coke nuts to make the charge to go into the furnaces. The furnace workers are divided into three eight-hour shifts and each shift must tap the furnace three times. They say, "Casting is into sand moulds and it can explode. This is a new process. Previously, we tapped from the furnace into ladles. Workers are more exposed to heat and fumes now."

Workers suffer extreme heat stress at the furnaces, enough to raise their core body temperature. Each tapping takes about an hour and that is as long as anyone can endure it. They then need time to recover before the next batch must be tapped. At Ferrometals, workers say the union and management are currently looking at how to reduce the working temperature of around 39°C. They say that more than 34°C will induce heat stroke. According to the US Occupational Safety and Health Administration, the 'threshold limit value' for heat exposure with heavy work is 30°C with 75% rest to 25% work.¹⁵

Workers say that the furnace workers do not live longer than five years after retirement. That is the permanent workers who have full protective clothing and masks. Workers who are periodically exposed, such as electricians doing maintenance, do not have the full kit. But those most exposed, on the tapping floors and elsewhere, are the casualised workers known as 'contractors'. They

¹⁵ https://www.osha.gov/dts/osta/otm/otm_iii/otm_iii_4.html at 14 June 2017.



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do not get the same protective kit and few have medical aids. Some are not unionised and, without union backup, are often unable to access the protection of post-apartheid labour law.

The Ferrovelde plant is located alongside Ferrometals. It is a joint venture between Samancor and Elkem, a Norwegian company, and makes an electrode paste used on electrodes in the furnace. It gives off coal tar pitch volatiles (CTPV), similar to VOCs and containing a wide variety of carcinogens including Benzene. However, there is generally a lag of years if not decades before workers become ill. By then, they may have retired, moved on or been made redundant.

The Mpumalanga smelters were heavily restructured from the late 1990s. The corporations cut the workforce and introduced outsourcing and casualisation. At its height, the Highveld Steel complex, including Vanchem, employed over 7 600 permanent workers. When it closed, Highveld Steel employed 2 230 permanent and 490 contract workers. Vanchem, now a separate business, employed 440 permanent and close to 600 contract workers. The contract workers were mostly without medical aid. A year on from closure, the medical aids of the permanent workers are also gone. The workers say that those with chronic occupational health conditions are now without treatment and they are dying.

Collectively, the Highveld workers are still owed retrenchment packages amounting to R300 million. Following closure, they were paid from the Unemployment Insurance Fund (UIF) but only for six months. A scheme for reskilling retrenched workers, administered by the Department of Labour (DoL), was also supposed to provide workers with a stipend. The DoL failed to pay it and the scheme collapsed. Gideon du Plessis, Solidarity's General Secretary, believes that government was punishing Numsa for dropping support for the ANC.¹⁶

While only Highveld and Vanchem have closed down, all the remaining plants have shed jobs. The unions were relatively successful in saving jobs at the Samancor smelters. They lost nine jobs at Middelburg Ferrochrome but

16 Gideon du Plessis, *Highveld Steel – an anti-SA agenda – tale of tragedy, treason*, BizNews, 14 March 2016.



there were many more redundancies at the chrome mines. Columbus Steel, however, claimed that it had not made a profit in eight years and cut 220 jobs. That included 31 Numsa members as well as Solidarity members. The cut fell heaviest on non-union contract workers.

The company then restructured from a four to a three shift system but with the factory still operating 24 hours a day. Shifts got longer, with eight hour shifts in the week and 12 hour shifts from Friday to Sunday. And workers now work 18 days instead of 10 before they get a weekend break. In consequence, the number of injuries on the job has been on the rise and most are related to fatigue.

Workers note that the new system contravenes the Basic Conditions of Employment Act. They have had several plant level meetings with the company to negotiate compliance with the Act. The next step will be to refer the matter to the Bargaining Council. They are reluctant to resort to strike action for two reasons: a three-month-long wage strike in 2013 left workers out of pocket and some have not yet recovered financially; and in the present economic context they fear closure of the plant. "In a strike," they say, "we are all losers." The companies, however, treat them as the enemy when they raise issues. This places shop stewards in the front line as management targets them for dismissal. Consequently, there is a high turnover of shop stewards but, "if we do not have shop stewards, the company will exploit workers". The companies do not acknowledge worker's needs but focus only on profit.

They don't even want to understand how unions work. It's not that we want to bring the company down. We also want our company to be sustainable because we want the jobs. We think of the members as well as the company, but they don't.¹⁷

As is common across all sectors in South Africa, workers say that bosses obstruct recognition of occupational health cases. Company doctors take their instructions from management and also try to conceal the link between illness and work. "Doctors who are fair do not last long." Independent doctors called in

¹⁷ Interview with Numsa shop stewards, 10 March 2016.



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by the union frequently give different advice. But if workers are not unionised, management usually gets away with it. Management also puts pressure on doctors to order an early return to work and resent workers put on light duty.

At Highveld Steel, meanwhile, the structural steel plant has been reopened. It will make heavy steel beams and the like from steel slabs supplied by ArcelorMittal. There are about 400 jobs. “None of the shop stewards are called back,” say the workers. Management is aiming for a docile workforce.

Chemicals in the hood

“They are killing us but they don’t even give us jobs.” People in eMbalenhle, the township next to Secunda where Sasol 2 and 3 are located, complain of eye irritation and headaches as well as lung infections resulting from the pollution. “On cloudy days, there are high levels of ammonia ... When Sasol releases steam at night, there is a bad odour. You can tell by the different smells that there are chemicals. When you open the windows at night, you inhale the chemicals.”¹⁸ Those who have worked there say the coke plant is particularly dangerous. “Your overalls show the dirt that you are exposed to.” And you can smell it in the middle of the night in eMbalenhle.

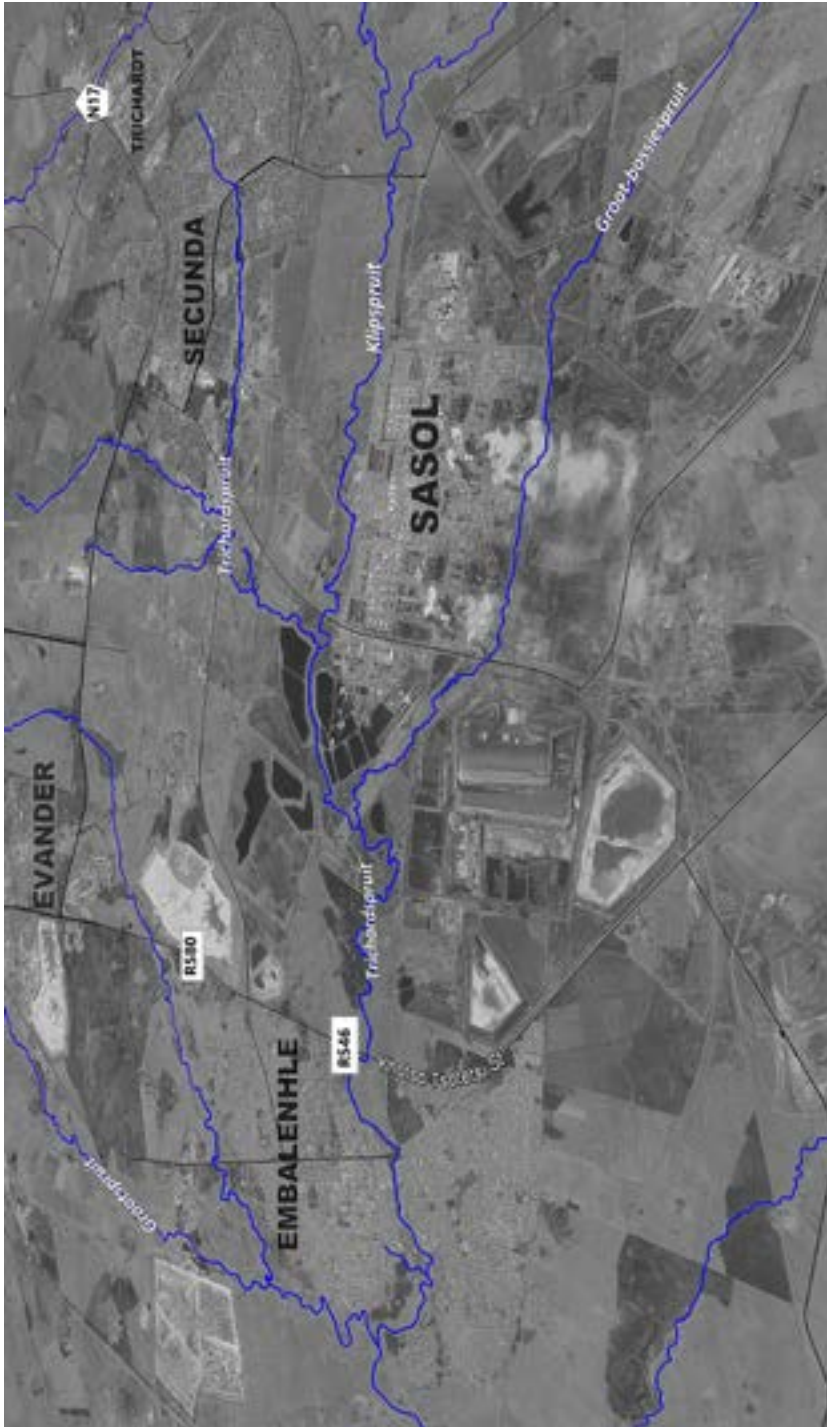
The sense of injury goes deeper than jobs and health. Many people now living in eMbalenhle were moved two or three times when Sasol moved in and started constructing the Secunda plants in the late 1970s. David Mahlangu’s family was moved off a local farm, first to Kinross, then to Driefontein and finally to eMbalenhle. Khehla Mahlangu (not related) was born in Driefontein and moved directly into one of the original eMbalenhle matchbox houses thrown up to make Secunda’s township. There is nothing left of Driefontein. Its place, say the people, is now occupied by the Graceland Casino close by Secunda town. Kinross was set aside for ‘coloureds’ and Indians.

Like Sasolburg, the original company town, Secunda was built as a garden city with wide and leafy streets. It even has a small wildlife park to show, as Sasol

18 Interviews with Elias Makubo, David Mahlangu, Amos Mnisi, Khehla Mahlangu and Lucky Cindi, 14 March 2017.



Map 3: Secunda and eMbalenhle



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puts it, that “nature and technology should co-exist”.¹⁹ Just upstream is the older town of Trichardt which is located on the Highveld Ridge. To the north of the ridge is the Olifants catchment. The Trichardspruit runs south in the Vaal catchment. It flows through a series of decorative dams that create a green corridor through Secunda.

eMbalenhle is located downwind of the Sasol plant and just across the R546 from its massive discard dumps, ash dumps, tar pits and effluent ponds. The Trichardspruit is joined by the Rietspruit and the Bossiespruit as it runs between these toxic sumps. The main Sasol plant lies between the two smaller streams. The river then flows on through eMbalenhle and into the Watervalrivier. It is frequently contaminated by spills from Sasol, notably following heavy rain when one or more effluent dams overflow and sometimes fail. This is on top of the everyday leaching of toxics from the ash and effluent dams into groundwater or into the streams. Spills also occur when pipelines or associated equipment fail.²⁰

Ash dumps and effluent ponds are also a source of air pollution, as fly ash particulate matter is blown off the dumps or volatile organic compounds evaporate from the effluent dams. The main blast of air pollution, however, comes from the stacks as described above. Very high levels of fine particulates (PM_{2.5}) – over five times the ambient standard – measured at the DEA’s monitoring station in eMbalenhle suggest that Sasol’s plume frequently comes to ground there. In different conditions, it may rise high over the township and come down in Johannesburg or, according to how the wind blows, in Ermelo to the east or Amersfoort to the south east. Or it might blow over KwaZulu-Natal and even out to sea. But it is never really blown away. Finally it comes to earth [see Chapter 2].

Local people remark that Sasol’s bad air makes for good business for medical practitioners. “If you have money, you go to a private doctor because they give better treatment,” they say. “Doctors tell you that you have asthma or TB

19 *Sasol: 50 years of innovation*, Sasol, 2000.

20 Centre for Environmental Rights (CER): *Full Disclosure 2016* and Sasol’s response to the CER’s report at report at <http://fulldisclosure.cer.org.za/company/sasol-limited>.



but don't tell you why. They don't talk about the pollution."²¹ They say there are five public clinics in the area, including two built by Sasol but run by the Department of Health. They are used by people without medical aid and they start queuing at five in the morning. The best facility in Secunda is Sasol's clinic at the plant but it is exclusively for Sasol's permanent workers. Contract workers are treated only if there is an accident but must rely on the public health system for occupational illness.

Everything in Secunda revolves around Sasol. The men of eMbalenhle know the inside of the plant because they have all worked there at some time – many of them for sub-contractors. They say that Sasol now prefers to recruit people from outside the area while sub-contracting companies are from out of town and bring their own labour with them. Khehla Mahlangu regularly organises protests for jobs and recently demanded that Sasol should bring all the sub-contractors together so “we could tell them they need to employ local people”. Sasol told them there were 250 service providers on site at any one time so this was not practical.

Class war

Sub-contracting has grown since the 1980s when most workers were directly employed by Sasol, says Jabulani Makathini, an organiser for Numsa. This reorganisation of work was imposed following the defeat of strikes organised by the unions which had recently created Cosatu. In 1987, Anglo and the apartheid state together deployed massive force to crush a strike by over 370 000 members of the National Union of Mineworkers (NUM). On the Highveld, police invaded hostels at the Matla and Optimum coal mines. Workers were teargassed and forced underground, where they struck again and were teargassed again. The cost to the workers was heavy: 11 were killed, 600 injured, over 500 arrested, over 50 000 dismissed. Sasol likewise called out the police to suppress a strike by the South African Chemical Workers Union in Sasolburg. Over 3 000 workers were dismissed.²²

²¹ Interview with Elias Makubo, David Mahlangu and Amos Mnisi, 14 March 2017.

²² A more detailed account of these strikes is given in The groundWork Report 2006: 107.



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At Highveld Steel, the militant Numsa branch had all but taken control of the workplace. The Anglo management staged a lockout to regain control. They followed that with the threat of evicting the migrant workers from Numsa's key base in the KwaGuqa hostels. After four weeks, the workers returned to work and "were left in no doubt that they had been defeated, and that they were returning on management's terms" [Von Holdt 2003: 137]. The police were there in force and management identified militants for instant arrest. The power of the union was broken and divisions between migrant and local workers widened. Rebuilding the organisation was slow and it could never again challenge for control of the workplace.

The leading corporations were then able to restructure labour as described in Part 1 of this report: an inner 'core' of full time permanent workers have improved wages and working conditions and access to formal rights under the post-apartheid labour laws; outside this core are 'non-core' outsourced workers employed by sub-contractors or as fixed-term contract labour with uncertain rights; and in the peripheral zone beyond this are the informal workers and the unemployed. All workers are more or less insecure and at risk of being exiled to the periphery [Webster and Von Holdt 2005]. This pattern is reproduced across all the major industries of the Highveld – in Eskom, Sasol and the metal smelters as much as in the mines.

Makathini says Numsa has members employed by Sasol and Sasol sub-contractors. He thinks the majority of workers at Sasol are outsourced. They do the dirtiest work and are most vulnerable in terms of rights and job security. In response to the oil price crashing in 2014, Sasol implemented ferocious cost cutting under the name of Project Phoenix. Between 2012 and 2016, it cut global direct employment by 4 800 – from 34 916 to 30 100. Most went in the year to June 2015. As David Constable, Sasol's then CEO, delicately put it, "nearly 2 500 voluntary separations and early retirement applications were approved by the company." The real savagery was reserved for outsourced workers. Constable continued, "In addition, our external spend for service



providers has reduced dramatically by 10 400 contractors on a monthly basis.”²³

Makathini says between 300 and 400 Numsa members lost their jobs to Project Phoenix and Secunda’s economy went into recession – as did Sasolburg’s.

Corruption hangs as heavy in the air as the smell of pollution. Sasol’s global ‘social investment’ spend is R1.2 billion a year. Most of it is spent in South Africa. In eMbalenhle, people say that the municipality runs to Sasol whenever it needs money. But the money given for various purposes – such as renovations to the eMbalenhle sewage works, installing an electricity sub-station, paving or fixing roads – just disappears. Sasol also has a R2.2 billion budget for ‘preferential procurement’ in Secunda and Sasolburg. Local people say that a number of prominent politicians have interests in sub-contracting and supplier companies and suggest that Sasol is basically handing out patronage.

The most notorious case concerns the majority union at Sasol, the Chemical, Energy, Paper, Printing, Wood and Allied Workers’ Union (Ceppwawu). Simon Mofokeng is the general secretary. In June 2013, the Sunday Times reported that his wife owned a company, Khotso-Batho, with a Sasol contract worth R60 million a year. Mofokeng himself was on the payroll and, between them, the couple drew salaries of R340 000 per month. Khotso-Batho workers said they were not allowed to join a union, were paid poorly, were often paid late and were forced to work overtime without pay. The Times was told that Khotso-Batho’s performance was poor but Mofokeng used his union position to secure extensions to the contract. “Everyone knew that if you keep Simon happy, there won’t be a strike.” Following the Times report, Sasol terminated the contract and pretended that it had not noticed various irregularities in a contract that had run for 13 years. “... where acts of fraud are identified, we will act swiftly and decisively,” said Constable.²⁴ Sasol also said it would report a case of fraud to the police. If this was done, nothing has come of it.

23 Sasol Annual Integrated Report (AIR) 2015 [17] and Sustainability Report 2016 [18].

24 Mzilikazi Wa Afrika and Stephan Hofstatter, *Union boss scores big in shady Sasol deal*, Times Live, 23 June 2013; Sasol, *Sasol statement to The Sunday Times (SA) Content*, 4 August 2013; *Workplace report from Khotso Batho: workers used and discarded by CEPPWAWU general secretary*, workers statement published by Democratic Socialist Movement, 21 August 2013.



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Mofokeng, meanwhile, retained control of Ceppwawu by the simple expedient of not convening a national congress which was due in 2014. While leading the union to bankruptcy and failing to account for the subscriptions paid by union members, he retained control over Ceppwawu's investment trust which is said to be worth up to R6 billion. In 2015, the deputy general secretary led a rebellion backed by four Ceppwawu regions. Mpumalanga was not amongst them. The rebel group said that the investment fund had not paid dividends to the union since 2012. But the heart of the issue was that Mofokeng had betrayed the "union's founding traditions and values, as a worker-controlled, democratic and accountable union".²⁵

In May 2015, the registrar in the Department of Labour approached the Labour Court to put the union under administration because it was out of compliance with the Labour Relations Act and with its own constitution. This action was cut short by Mildred Oliphant, the Minister of Labour. First, she instructed the registrar to drop the case and, when he refused, she sacked him. The rebel group said that she was protecting Mofokeng in concert with the Cosatu leadership which needed Ceppwawu's votes in the battle to expel Numsa and sack Cosatu General Secretary Zwelinzima Vavi. The registrar, who is required by law to act independently, appealed to the Labour Court against his dismissal. In January 2017, he won the case and is back in office. It is expected that he will reinstitute the bid to put Ceppwawu under administration.²⁶

At issue in the battle for control of Cosatu was the federation's support for the ANC and more particularly for President Jacob Zuma. Vavi and Numsa were expelled because they opposed Zuma and questioned the alliance with the ANC. Two years later, in April 2017, worker revulsion at the unending scandals attending Zuma's presidency forced the Cosatu leadership to call for his resignation. The leadership nevertheless invited him to address the federation's 2017 May Day rally, only for the workers to heckle him off the

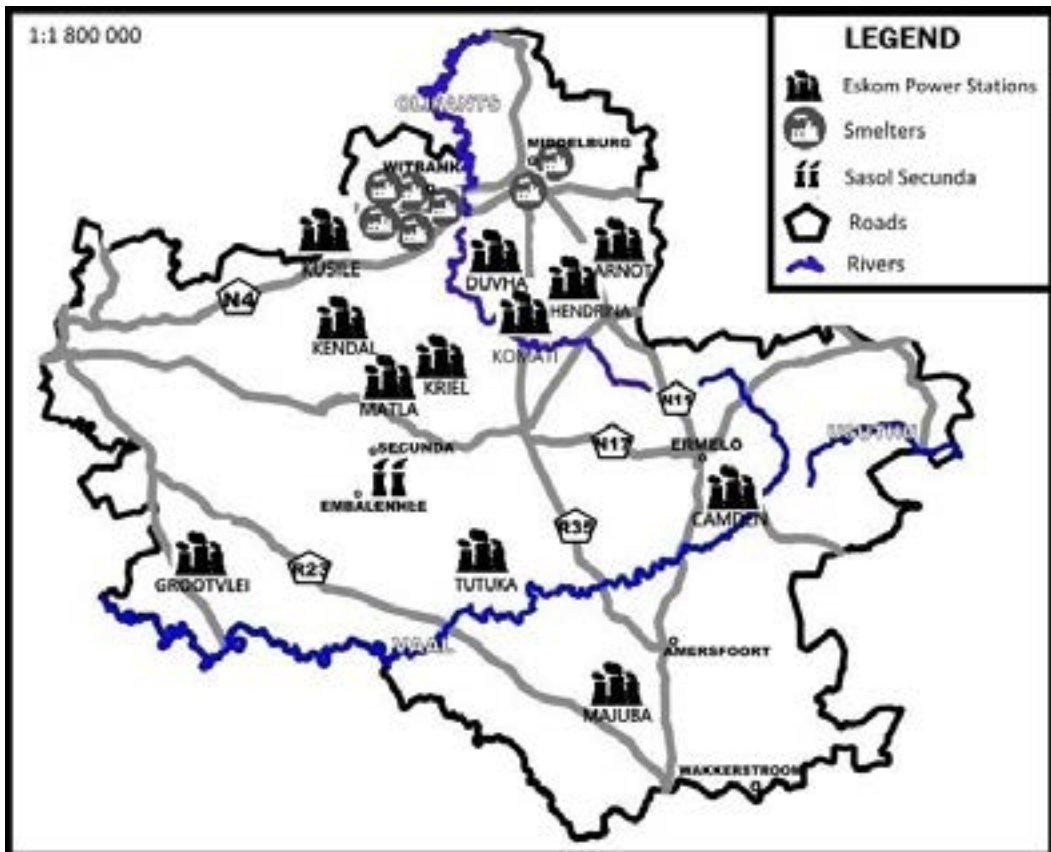
25 Statement by Ceppwawu Regions, *Mildred Oliphant protecting Simon Mofokeng*, 30 July 2015.

26 Dewald van Rensburg, *Back to work after unlawful layoff*, City Press, 29 January 2017; Terry Bell, *Inside Labour: State of the unions: lessons to be learned*, Fin24, 10 February 2017.



stage. Zuma left as he came, in a black limousine with eight body guards trotting alongside. But the display of power was rendered absurd.²⁷

Map 4: The Mpumalanga Highveld.



27 Natasha Marrian, *Cosatu calls on President Jacob Zuma to resign*, Business Day, 4 April 2017; Pieter du Toit, *May Day 2017: Zuma's Alliance Smashed To Smithereens*, HuffPost, 1 May 2017.



2

Dirty air

Much has been learnt about pollution on the Mpumalanga Highveld since concern first emerged around the coal mines and early coal burning industries in Witbank [Singer 2011]. Enough is known to deal with emission sources, set proper standards for ambient air quality and protect people against it. But in a history spanning more than 50 years, since South Africa's first Atmospheric Pollution Prevention Act (APPA) was legislated in 1965, little progress has been made, and people living in the Highveld are still subject to horrific pollution. Why?

This chapter tackles this question by (1) explaining the impacts of pollutants released from burning coal on people and ecosystems; (2) explaining the atmospheric dynamics of the Highveld and the pathway of pollutants after emission; and (3) tracing a history of civil society, research and regulatory politics from the start of the APPA through to the Air Quality Act (AQA) of 2004 and present day struggles in the Highveld Priority Area, including an attack on emission standards by Eskom and Sasol.

In the process, this chapter shows that the destruction of the Highveld via air pollution is characterised by the following patterns:

1. Health, ostensibly the reason for air quality management (AQM) on the Highveld, has been curiously neglected, both in research about health effects and in actual provision for inhabitants suffering from pollution impacts on their health.
2. Early warnings regarding the unsuitability of the Highveld climate for pollution dispersion have been ignored and massive amounts of pollutants have been emitted into the Highveld airshed.



3. Air quality regulation from government has, since the earliest days, been extremely careful not to 'burden industry' with requirements for air quality regulations. This pattern has been sustained by an unequal power relationship between officials and corporates.
4. An enduring lack of capacity for managing air quality, lasting more than five decades, at national and local government levels, has been repeatedly identified since the early years but is not resolved to this day.
5. There is a strong and enduring tendency in industry to accord itself superior knowledge of pollution, its abatement, and the power to decide where investments in improvement should be made. This superiority complex extends to the point of overriding democratic processes and their implementation, as seen in both Eskom and Sasol's successful applications to postpone compliance with new air quality standards.
6. Extensive knowledge of air quality issues exists in South Africa, at universities and the Council for Scientific and Industrial Research (CSIR), but this knowledge has not translated into effective protection of people and ecosystems. In some cases researchers, with their studies and students funded by the big polluters Eskom and Sasol, have found reasons to delay or weaken attempts at air quality regulation [Pretorius 2015; Galpin and Held 2002]. Researchers have repeated descriptions of air quality problems without solving them.
7. Monitoring systems for air quality have been incomplete, dysfunctional or secret.
8. In the political arena, such improvements as there have been in South Africa's air quality regulation, have been almost exclusively the result of activist pressure against a reluctant regulator.
9. The need to build a public understanding of the impacts, importance, dynamics and causes of air pollution has been noted since early times but has not received priority. Air quality managers have not built a popular constituency in favour of air quality management.



Breathing is not a choice

Industry's choice to use the atmosphere as a drain for their pollutants, and government's reluctant regulation of air pollution, inevitably impact on people on the Highveld who have no choice but to breathe in pollutants. Breathing is not a choice. The atmosphere is a commons and, by polluting it, industry has enclosed it.

Air pollution affects different people in different ways. "An active person typically inhales 10 000 to 20 000 litres of air each day – approximately 7 to 14 litres every minute ... This intake increases with vigorous exercise ... a jogger may inhale up to 3 000 litres per hour" [Elsom 1996:30]. When we breathe, we draw air into 300 million tiny air bags (called alveoli) which, if spread out, would cover an area the size of a tennis court. The air, together with any pollutants it contains, enters the blood stream via these tiny air bags, rich in blood vessels. From there they travel via the blood to other organs in the body.

It makes a difference how we breathe. Nasal breathing stops the bigger particles through the nose hair and nasal passages, whereas breathing through the mouth offers no such filter. People involved in strenuous activities, including strenuous work and sport, often breathe through the mouth, as do children and asthmatics. Children are more vulnerable because they breathe in more air per body weight than grown-ups, have narrower airways, are more often physically active and spend more time outdoors, although indoor pollution may be worse than outdoor pollution for the individuals exposed to it.

Some people are more vulnerable to air pollution than others, especially those with asthma, the very young and the elderly, and those who have grown up in polluted areas. Pollution impacts range from minor irritation, such as headaches, tiredness, nausea and irritation of the eyes, nose and throat, through to serious illness (asthma) and premature death. The impact depends on frequency and duration of exposure, the underlying state of health, the level of activity and which pollutants one is exposed to:

Pollutants can sensitise the respiratory tract to asthma and hay fever, with the symptoms being triggered by common allergens such as



pollens. Pollutants can worsen heart and lung disease and contribute to the development of such diseases as bronchitis, emphysema and cancer. They can add stress to the cardiovascular system, forcing the heart and lungs to work harder for the same effect (getting oxygen rich blood to organs in the body). Some pollutants can damage the cells of the airways of the respiratory system, reducing the ability to clear foreign bodies, including bacteria, from the lungs, so weakening their defences against infection. They can reduce the lungs' ability to exhale air, which is part of the body's natural ageing process, but exposure to air pollution speeds up this process... Air pollution drastically increases the presence of asthma, as well as incidence and severity of allergies in children [Elsom 1996: 31].

This list does not exhaust the effects of air pollution. There are air pollutants that lead to cancers, including lung cancer. Some pollutants affect the unborn child, causing symptoms from low birth weight to compromised development. The Physicians for Social Responsibility (PSR) followed an organ-system approach rather than tracking the effects of pollutants in isolation (Lockwood et al, 2009). They identified effects on the respiratory (breathing) system; the cardiovascular system (heart and circulation of blood); and the nervous system. Pollutants are breathed in together, and affect the body in a synergistic way (working together). Some pollutants are irritants, like sulphur, weakening the body and making it more vulnerable to the impacts of other pollutants, like particulate matter (various forms of smoke and dust) that can reach deep into the lungs.

Pollutants released in burning coal

More than 70 pollutants are known to be released during the operation of coal-fired power stations [Lockwood et al 2009]. Similar numbers come from steel and other metallurgical works [Kanchan 2013] and from petrochemical plants, such as Sasol in Secunda.

Because of their health effects, as well as effects on water, soils, ecosystems, crops and buildings, and the practicalities of measuring and controlling them,



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Table 1: Coal pollutants' major health effects

Disease or condition	Symptoms or result	Most vulnerable populations	Coal pollutants implicated
Respiratory system			
Makes asthma worse	Coughing, wheezing, shortness of breath, and breathlessness with a range of severity from mild to requiring hospitalization	Children, adults	NO ₂ O ₃ PM SO ₂
Asthma development	New cases of asthma, resulting in coughing, wheezing, shortness of breath, and breathlessness with a range of severity from mild to requiring hospitalization	Children	NO ₂ O ₃ PM
Chronic obstructive pulmonary disease (COPD)	Emphysema with chronic obstructive bronchitis; permanent narrowing of airways; breathlessness; chronic cough	Smokers, adults	NO ₂ PM
Stunted lung development	Reductions in lung capacity; risk factor for development of asthma and other respiratory diseases	Children	NO ₂ PM _{2.5}
Infant mortality (relevant organ system uncertain, may be respiratory)	Death amongst infants younger than one year	Infants	NO ₂ PM
Cardiovascular (heart and circulation)			
Lung cancer	Shortness of breath; wheezing, chronic cough; coughing up blood; pain; weight loss	Smokers, adults	PM



Cardiac arrhythmias	Abnormal rate or rhythm of the heart; palpitation or fluttering; may cause fatigue, dizziness, light-headedness, fainting, rapid heartbeat, shortness of breath and chest pain	Adults, hypertensives, diabetics, those with cardiovascular disease	NO ₂ PM _{2.5} SO ₂
Acute myocardial infarction	Chest pain or discomfort; heart attack	Adults, diabetics, hypertensives	PM _{2.5}
Congestive heart failure	Shortness of breath, fatigue, oedema (swelling) due to impaired ability of heart to pump blood; can result from narrowed arteries, past heart attack, and high blood pressure, can lead to death	Adults, hypertensives, diabetics, those with cardiovascular disease	PM _{2.5}
Neurological			
Ischemic stroke	Artery supplying blood to the brain becomes blocked due to blood clot or narrowing; may cause sudden numbness or weakness, especially on one side of the body, confusion, trouble speaking, seeing and/or walking; dizziness, severe headache; effects can be transient or permanent	Elderly, hypertensives, diabetics	NO ₂ PM _{2.5} PM ₁₀ SO ₂
Developmental delay	Reduced IQ; mental retardation; clinical impairment on neurodevelopmental scales; permanent loss of intelligence	Children	Mercury and other heavy metals

Adapted from Lockwood et al [2009]

Pollutants: Sulphur dioxide (SO₂), Nitrogen dioxide (NO₂), Ozone (O₃), coarse Particulate Matter (PM₁₀), fine Particulate Matter (PM_{2.5}).



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a limited number of priority pollutants have been selected for monitoring and control. The World Health Organisation (WHO) has set guideline standards – they are not binding on countries – and provided scientific arguments for them [WHO 2005].

Health effects are established by observation and experiment of the impact of pollutants, usually drawn together in large scale reviews of scientific literature (for example the WHO 2005). The WHO works with thresholds, that is levels of concentration of pollutants in the atmosphere (indoors and outdoors) that can be shown to have adverse effects. Researchers are constantly discovering that there are adverse effects at lower levels than previously thought and that there are no safe levels for some pollutants, including: Particulate Matter, mercury and Volatile Organic Compounds (VOCs) such as benzene, toluene, ethylbenzene and zylene (known together as BTEX). Also, there are different vulnerabilities in the population: the elderly, children, asthma sufferers and people previously exposed are more sensitive to pollution. There are also studies that show how clear improvements in the health of populations follow on improved air quality as a result of stricter controls on air quality [WHO 2005].

Standards can be set for emissions (what leaves a factory or power station stack) and for the ambient air (the overall concentrations of pollutants present in the air), and these can be monitored. However, this does not mean that the quality of all ambient air is the same in one region, or that monitoring stations give a complete picture. The incompleteness is often filled in through computer modelling. These uncertainties, and the need to make assumptions about what to feed into models, create the space for competing arguments, narratives and decisions about how to ‘control pollution’. The mere existence of an air quality management system creates a narrative that reassures the public that ‘pollution is under control’ and legitimises current emissions. There are also other narratives: for example that, because indoor pollution is a serious issue, industry’s pollution can be ignored, or that industry can ‘balance’ their ongoing pollution through offset strategies that often have very little to do with air pollution.



Countries also set standards based on calculations of technological and economic feasibility of pollution control: the cost of installing and operating different pollution control technologies, water and power costs, and the efficiencies of different measures. Eskom, for example, has chosen electrostatic precipitators (ESPs) for removing PM at two thirds of their power stations, while the more efficient Fabric Filter Plants (FFPs) are used at the other third. [Pretorius 2015].

In some cases, these calculations are based on evidence of health impacts. In other cases, health impacts are largely ignored, as was the case under apartheid (see below). The politics of economic growth and development may be used to argue that pollution impacts – such as from SO₂ emissions by Eskom – should be ignored because dealing with them would be ‘too expensive’. The relative absence of health impact research in most Third World countries, including South Africa, makes it easier to ignore these impacts. As a result, countries may choose national standards that do not adequately protect people.

Priority Pollutants

There are seven priority pollutants in SA named in the national ambient air quality standards in 2009: PM₁₀ (coarse particulates), sulphur dioxide, nitrogen dioxide, carbon monoxide, ozone, lead and benzene. A PM_{2.5} (fine particulates) standard was added in 2012.

The pollutant that has historically received most attention in South Africa is particulate matter (PM), which comes in different sizes and from a range of sources. Coarse particulates (PM₁₀) are defined as particles smaller than 10 microns, and fine particulates (PM_{2.5}) as 2.5 micron or smaller. A human hair, by comparison, is around 70 micron thick. In 2014, Greenpeace researcher Lauri Myllyvirta calculated that exposure to fine particulate matter (PM_{2.5}) from Eskom’s coal-fired plants was currently causing an estimated 2 200 deaths per year, including approximately 200 children. Combining these premature deaths with the costs from the neurological effects of mercury on children, he estimated the economic cost to society at R30 billion per year. In 2017,



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this order of damage and costs was confirmed by econometrics researcher Mike Holland.

Coal-fired power stations carry responsibility for the highest mercury emissions of all sources in South Africa, with annual coal-fired power station mercury emissions in 2006 at 39 tonnes for the year [Masekoameng et al 2010 cited by Pretorius 2015]. Mercury that lands in the sea or in lakes and dams contaminates the food chain as it becomes available to fish and to the people that eat them. The Minamata Convention on Mercury entered into force on the 16th of August 2017. It does not establish numerical targets for reducing emissions but, as groundWork researcher Rico Euripidou points out, power stations will be required to follow BAT/BEP practices – best available technologies/best environmental practices – to curtail emissions. New facilities will not be required to have mercury pollution controls for five years after the treaty enters into force, while existing facilities are given ten years before they begin their control efforts.

Sulphur dioxide is an important pollutant. It is an irritant that weakens lung function, leads to inflammation, predisposes to asthma and worsens asthma. It is a precursor to the sulphur fraction of PM_{2.5} and to the formation of ozone. It also has acidifying impacts when landing from the air on the soil or in water. Nevertheless, SO₂ has not been controlled by Eskom, the biggest emitter of this pollutant at 1 699 000 tonnes per year²⁸ – almost ten times more than the next biggest emitter, Sasol at 190 172 tonnes per year [DEA 2011].

Secondary pollutants like ozone (O₃) are formed after the release of emissions as chemicals mix in the air. Secondary pollutants therefore cannot be monitored in the stack but are modelled – calculated in a computer programme – on the basis of known air chemistry. They are, however, measured in ambient air monitoring.

The following table explains the priority pollutants and their health effects in more detail. A second table pays attention to four VOCs – the BTEX group – that arise from burning of coal, especially under circumstances of incomplete combustion. Note that there are a large number of these chemicals. These

28 Eskom Annual Report 2016.



four are selected because of their prominence in the petrochemical industry,²⁹ including at Sasol’s plants.³⁰

Table 2: Priority pollutants and their impacts on health

Pollutant	What is it?	How is it produced?	Health effects
Ozone	Ozone is a highly corrosive, invisible gas	Ozone is formed when nitrogen oxides (NO _x) react with other pollutants in the presence of sunlight.	Rapid shallow breathing, airway irritation, coughing, wheezing, shortness of breath. Makes asthma worse. May be related to premature birth, cardiac birth defects, low birth weight and stunted lung growth.
Sulphur dioxide (SO₂)	SO ₂ is a highly corrosive, invisible gas. Sulphur occurs naturally in coal. ³¹	SO ₂ is formed in the gases when coal is burned. SO ₂ reacts in the air to form sulphuric acid, sulphates and in combination with NO _x acidic particles.	Coughing, wheezing, shortness of breath, nasal congestion and inflammation. Makes asthma worse. SO ₂ gas can destabilize heart rhythms. Low birth weight, increased risk of infant death.
Nitrogen Oxides (NO_x)	A family of chemical compounds including nitrogen oxide and nitrogen dioxide. Nitrogen occurs naturally in coal.	NO _x is formed when coal is burned. Can convert to acidic PM _{2.5} in the atmosphere. Reacts in the presence of sunlight to form ozone smog.	NO _x decreases lung function and is associated with respiratory disease in children.

29 Also see the following report about industry knowledge of the carcinogenic effects of benzene: <https://www.publicintegrity.org/2014/12/05/16361/dozen-dirty-documents>

30 See groundWork 2003 for a full table.

31 Highveld coal is relatively low in sulphur but, at the scale that it is burnt, that hardly matters



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<p>Particulate Matter (PM) comes in different fractions: coarse (PM₁₀), fine (PM_{2.5}) and ultra-fine (PM₁)</p>	<p>A mixture of small solid particles (soot) and tiny sulphuric acid droplets. Small particles are complex and harmful mixtures of sulphur, nitrogen, carbon, acids, metals and airborne toxics.</p>	<p>Directly emitted from coal burning. Formed from SO₂ and NO_x in the atmosphere.</p>	<p>PM_{2.5} crosses from the lung into the bloodstream resulting in inflammation of the cardiac system, a root cause of cardiac disease including heart attack and stroke and leading to premature death. PM exposure of pregnant women is also linked to low birth weight, premature birth, chronic airway obstruction and remodelling, and sudden infant death.</p>
<p>Mercury</p>	<p>A metal that occurs naturally in coal.</p>	<p>Mercury is released when coal is burned.</p>	<p>Developmental effects in babies who are born to mothers who ate contaminated fish while pregnant. Poor performance on tests of the nervous system and learning. In adults, may affect blood pressure regulation and heart rate.</p>
<p>Carbon Dioxide</p>	<p>Coal has the highest carbon content of any fossil fuel.</p>	<p>Carbon dioxide is formed when coal is burned.</p>	<p>Indirect health effects associated with climate change including the spread of infectious disease, higher atmospheric ozone levels, and increased heat – and cold-related illnesses.</p>

Source: Lockwood et al 2009: 9



Table 3. BTEX (selected Volatile Organic Compounds).

Sources and uses	Characteristics	Health effects
Benzene		
<p>Manufactured from some crude oils for use in commercial solvents and chemical feed-stocks for making plastics, resins, nylon and synthetic fibres, some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Industrial emissions, primarily from oil refineries, are the main source of benzene in the environment. Fugitive emissions from storage tanks, leaking valves and pipes and loading operations.</p> <p>Occurs naturally in volcanic gases.</p>	<p>Colourless liquid. Sweet odour. Evaporates easily. Dissolves slightly in water. Highly flammable.</p>	<p>Known carcinogen associated with leukaemia and cancer of blood-forming organs. Harm to bone marrow may reduce red blood cell count and so cause anaemia.</p> <p>Can cause excessive bleeding. Weakens the immune system. Inhaling causes central nervous system depression: high levels result in death, low levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion and unconsciousness. Swallowing causes vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate and death. Causes defatting of the skin. Long-term exposure (months) of women has caused irregular menstrual periods and decreased ovary size.</p>
Ethyl Benzene		
<p>Manufactured for use in solvents, fuels, and other chemicals – primarily styrene.</p> <p>Found in inks, insecticides, and paints.</p> <p>Occurs naturally in crude oil and coal tar.</p>	<p>Colourless liquid. Smells like petrol. Evaporates in air. Flammable.</p>	<p>Not well known.</p> <p>Available evidence suggests dizziness, throat and eye irritation, tightening of the chest, and a burning sensation in the eyes from inhaling high levels.</p>



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Toluene		
<p>Manufactured for use in paints, paint thinners, fingernail polish, lacquers, adhesives and rubber, and in some printing and leather tanning processes. Industrial by-product of oil refining and making coke from coal. Fugitive emissions from industry or consumer use of products. Found in surface water and groundwater from spills.</p>	<p>Colourless liquid. Sweet pungent, benzene-like odour. Evaporates easily. Flammable.</p>	<p>Affects central nervous system. Low to moderate levels cause tiredness, confusion, weakness, nausea, intoxication, and loss of memory, appetite, hearing and colour vision for the duration of exposure. High exposure damages kidneys and can cause unconsciousness and death.</p>
Xylenes		
<p>Fugitive emission from petroleum refineries, terminals and service stations, and manufacture and use of chemicals, polyester, paints, dyes, and lacquers. Emitted from combustion of petrol, wood and other biomass.</p>	<p>Colourless gas. Practically insoluble in water. Sweet odour.</p>	<p>Inhaling high levels causes irritation to eyes, nose and throat, nausea, vomiting and gastric irritation and neurological effects in the short-term. Long-term exposure affects the central nervous system causing headaches, poor muscle coordination, dizziness, confusion, and loss of balance. Also causes reduced lung function and laboured breathing, heart palpitations and chest pain and damage to blood and kidneys. Suspected developmental and reproductive damage. Suspected carcinogen.</p>

Source: groundWork [2003]

Limited health impact research

Health considerations are the very reason for air quality control. The second South African Chief Air Pollution Control Officer (CAPCO), Nico Boegman, started from the view that “minimum requirements for safeguarding health



are mandatory” while adding “but beyond that point cost must be the deciding factor in abatement policy formulation” [Boegman 1979: 102].

It is surprising that the research on the direct health impacts of air pollution on the Highveld has remained so limited. For example, a 1998 review by the Council for Scientific and Industrial Research (CSIR) found that health impact studies were inconclusive. The explanation that made the most sense to the authors was that “control measures have succeeded in maintaining levels [of pollution] below the thresholds of risk to human health” [Tyson et al 1988: 97]. But the more likely explanation was, as environmental reporter James Clarke argued, that this had more to do with the argument by South Africa’s “industrialists, health officials and politicians that there is nothing to worry about. They will assure us that, thus far, nobody has found irrefutable evidence that our chemical-laden air is unhealthy ... This evidence does not exist for one very good reason: nobody has conscientiously researched it” [1991: 18].

Some efforts have been made. An early study by Zwi et al [1991] found that boys on the Eastern Transvaal Highveld (ETH), as it was then called, were on average slightly shorter (by 0.83cm) and also concluded that “... in children, exposure to pollution in the ETH may cause respiratory symptoms and chest illness and may affect height but does not measurably affect lung function...”

More than ten years later, the 2003 Mpumalanga Air Quality Report recorded:

Little information could be obtained on the prevalence of respiratory infections in Mpumalanga province. Since respiratory infections are not notifiable, information is collected by some hospitals and clinics only. Access to this information is notoriously difficult to obtain due to issues surrounding doctor-patient confidentiality. In addition, the records of many non-urban hospitals are not kept on computer and are therefore difficult to access and query. Several clinics and hospitals in Mpumalanga were approached for this data, however none were able and/or willing to supply the information. [2003:46]



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This was confirmed by Wichmann and Vuyi [2005], who observed “...The case is strong for acknowledging the large public health risk arising from indoor and outdoor air pollution exposure in South Africa. Nevertheless, the 16 local air pollution epidemiologic studies reviewed here are fraught with systematic and random errors, thus limiting their validity and precision. Yet, the studies do provide some evidence of associations with a range of serious and common health problems” [2005: 290]

By 2011, Wright et al wrote that, up to then, two studies had assessed health risks as a result of air pollution in Mpumalanga – Zwi et al 1991 and John et al 2008. They could only identify three other related studies. A study in the Vaal Triangle had shown that children there had a 134% higher risk of developing upper respiratory diseases, and a 203% higher risk of developing lower respiratory diseases, than children from a less polluted area [Terblanche 1998]. A study in Soweto showed increased respiratory symptoms [Mathee and Von Schirnding 2003]. The South Durban Health Study included findings that “... relatively moderate ambient concentrations of NO₂, NO, PM₁₀ and SO₂ were strongly and significantly associated with decrements in lung function among children with persistent asthma”, that “attending primary school in south Durban, as compared to the north, was significantly associated with increased risk for persistent asthma and for marked airway hyperreactivity”, and that for adults, “residing in the south was significantly associated with hay fever, and marginally associated with chronic bronchitis, wheezing and shortness of breath, and hypertension” [Naidoo et al 2006: 7].

The DEA's Highveld Priority Area Air Quality Management Plan (HPA AQMP) was also published in 2011. It relied on earlier figures, from studies conducted in 2002, which focus mainly on the urban areas but not in Mpumalanga. Nevertheless, estimates were made about health impacts, namely that the primary drivers for hospital admissions in Mpumalanga are power generation (51%), the Sasol Secunda complex (17%) and domestic coal burning (12%) [2011: 72]. Point sources within the HPA with significant individual contributions were Highveld Steel and Vanadium and Sasol Secunda.



Annual Mpumalanga health impacts from combustion emissions enumerated by Scorgie [2004 cited in DEA 2011: 73] include:

- respiratory hospital admissions: 8 685;
- cardiovascular hospital admissions due to PM₁₀ exposures: 34.5;
- premature mortality due to PM₁₀ and SO₂ exposures: 16.8;
- chronic bronchitis due to PM₁₀ exposures: 6 440;
- restricted activity days due to PM₁₀ exposure: 31 542;
- minor restricted activity days due to SO₂ exposures: 32 135 642;
- leukaemia cases due to 1.3 butadiene and benzene exposure: 6.4;
- nasal carcinoma cases due to formaldehyde exposures: 0.3.

The HPA AQMP has not produced any more recent figures. Nor does it contain a discussion of health services to support the HPA. In our research, we could not find any evidence that the national or provincial health departments have launched any programmes to give support to the affected population. People in the area have no experience of such programmes – as recorded, for example, in Ackerville in Chapter 1 above.

Instead, research has focused on the effects of indoor pollution from fuels like wood, coal and paraffin on the health of people in those households, for example Albers et al [2015] for eMalahleni and Middelburg. Indoor pollution is a very important issue and the health of many people is affected, mainly as a result of energy poverty. In a country with a history of cheap electricity, many households have not had electricity and are forced to rely on these other fuels. Many households that do have electricity find it too expensive to use for cooking and heating, especially after the escalation of prices since 2008, and so fall back on polluting fuels.



Deaths, lost working days and other externalities

As the energy system – particularly the production of cheap electricity by burning coal – came under scrutiny in post-apartheid South Africa, a new focus emerged: externalities. Clive van Horen, for example, published *Counting the social costs: Electricity and externalities in South Africa* [1996]. Among these externalities were the occupational health effects of coal mining, water and air pollution from coal mining and power generation, impacts on people's health, acid deposition and visibility impacts from air pollution, water consumption, and greenhouse gas emissions from power generation. These studies make the point that there are extensive externalities – costs that Eskom takes no responsibility for and that are borne by others – beyond health impacts. A similar study looking at the predictable externalities from the new Kusile power station was undertaken for Greenpeace Africa [Blignaut et al: 2011].

To deal with the absence of detailed health data, these studies make use of an impact pathway approach which uses:

- emissions, or estimates of emissions;
- atmospheric dispersion models – what happens to the emitted pollutants, how they change and where they go;
- exposure of the population to these pollutants;
- the incidence of health effects – changes in effects on population at risk in the form of an established 'concentration response function'. These calculations are based on medical and pollutant chemistry research in other countries.

These calculations give numbers of:

- premature deaths – people dying earlier than they would have without the pollution burden;
- morbidity – a range of sicknesses that decrease quality of life and increase medical costs to individuals or the state; and
- working days lost as a cost to the economy and individuals.



In 2006, Eskom dipped its toes into the same waters, publishing an interesting if disconcerting study that explored what the health impacts would be if it did not comply with the new Air Quality Act and the anticipated restrictions that would be placed on its emissions. It considered scenarios for different combinations of abatement technologies, including not installing any at power stations that Eskom considered too close to the end of their working life to bother with. The study revealed that “current emissions from Eskom and other sources quantified during the study were predicted to result in 550 deaths per year and around 117 200 respiratory hospital admissions per year” [2006: 6-3]. These figures were used to compare scenarios for partial installation of abatement technology.

Installing no additional pollution control equipment would make future Eskom emissions responsible for 1 209 deaths and 155 623 respiratory hospital admissions per year as power generation and emissions increased. Installing 90% SO₂ controls only on three new power stations would result in an increase in mortalities of around 20% (661 deaths), and in respiratory hospital admissions of around 10% (128 765 admissions). Installing “90% control on new and eligible existing power stations” – only Kendal, Matla, Duvha, Lethabo, Tutuka and Majuba – would limit the number of deaths to 502 and respiratory hospital admissions to 118 108 [2006: 7-1].

These were serious underestimations. It was left to civil society – activists – to point out the real costs. In 2014, Myllyvirta also used the impact pathway approach to calculate the health costs of Eskom’s planned non-compliance with South Africa’s new emissions standards. He estimated 2 200 premature deaths per year and a cost of R30 billion to the country. This estimate was based on the impact of fine particulates (PM_{2.5}) and the emission of mercury. It did not count the impact of other emissions. In 2017, Holland confirmed the approach and figures but argued that, in addition to ‘equivalent attributable deaths’ of 2 239 per year, the costs of illness should be accounted for: chronic bronchitis in adults (2 781); bronchitis in children aged 6 to 12 (9 533); equivalent hospital admissions (2 379); restricted activity days for all ages (3 972 902); asthma symptom days, children 5 to 19 (94 680) and lost working



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days (996 628), at an additional cost of R3.5 billion to bring the total to R33.2 billion.³²

Possibly these types of calculations will have some policy impact. But there is something macabre about working with the figures of deaths and sickness that are caused by decisions of national institutions, and the numbers can never fully reflect the suffering and disease that they stand for. They stand as a stark reminder that air quality management is not able to deal with the impacts of burning coal in South Africa. It is also striking that these deaths can be ignored because the bodies are not seen. No account is made of the impacts of pollution on fenceline communities. And workers' bodies are forced into invisibility when sick. Numsa workers told us how companies on the Highveld often denied that workers were sick, forcing or encouraging company doctors to misdiagnose them, whether they sustained injuries in accidents at work or were suffering from occupational diseases. Recent business rescue interventions in the area have rescued capital but left sick workers without medical aid.

The worst possible place for coal fired power stations

The Highveld is an area in which “a large amount of pollution ... is injected into an atmosphere as unfavourable for its dispersion as that found anywhere in Southern Africa. Indeed the Highveld dispersion climatology must rate as among the most unfavourable anywhere in the world ...” [Tyson et al 1988:1]. This was the judgement of the authors of a CSIR and Wits University review of air quality on what was then known as the Eastern Transvaal Highveld undertaken in 1988.

The dispersion of pollution needs turbulent skies and strong mixing winds. But the Highveld weather system is the exact opposite. It is characterised by long-lived high pressure systems, which produce a very stable atmosphere with clear skies and low wind speeds. Pollution can linger without being dispersed. When it does happen, dispersion – the spread of pollutants into a larger volume of air with the result that the concentration is diluted – ultimately means that

32 \$int converted at R14/\$.



pollutants are transported elsewhere before they reach soil, water and people again. Some pollutants stay in the air for a few days while others can hang on for several weeks and can be transported over long distances. Mercury from the Highveld power stations, for example, can hang in the air for long enough to reach the Indian Ocean, as we discuss below.

In the Highveld winter, pollution is trapped in the layer of air closest to the earth as a result of temperature inversions, described in Box 2. These inversions occur for 80% of the time – or four nights out of every five. They stretch on average for 280 metres from the earth's surface into the atmosphere. Even in summer, inversions are frequent, occurring two nights out of three, but are shallower – on average 190 m – and weaker [Tyson et al 1988].

A typical winter surface inversion starts in the afternoon, endures the whole night, and is dispersed after sunrise. At Hendrina, for example, it starts about five o'clock in the evening as the earth cools down, reaches a maximum after four in the morning, and disperses when heated after sunrise.

For that period, any emissions that are released in this surface layer are trapped. This includes all ground-level dust from coal trucks and open cast mining, emissions from fires burning on coal mines and discard heaps and from the shorter industrial smokestacks and flares – such as at the metal smelters and at Sasol. It also includes smoke from household cooking and heating, smoke from burning uncollected waste in townships, and emissions from traffic.

Hence, as the people of Ackerville observe, the air is worse at night for two reasons: first, because of the inversion that traps the pollution, and second, because some industries switch off their scrubbers at night.

What kinds of pollution are trapped in the surface inversion layer? According to the DEA, and looking only at particulate matter generated at ground level, just under half (49%) is dust kicked up by coal trucks and blasting on opencast mines [DEA 2011: 19]. Against the 135 766 tons of particulates per year generated on mine haul roads, household fuel burning accounts for only 17 239 tons per year. We discuss household emissions below.



Box 2: What is an inversion?

Come five o'clock of a winter evening on the Mpumalanga Highveld, and a haze of smoke and dust settles in, first in the valleys and then everywhere. Evening dark comes prematurely and may goodness help you if you are on the road between thundering coal trucks on badly potholed roads. This is why Tyson et al called it the worst place to build a power station. This is the inversion settling in.

An inversion occurs when a layer of warm air traps a layer of cold air below it. Normally the air near the earth is warmer than the air above it and the energy (heat) in a parcel of air enables it to rise through the colder air above it. But when the air above is warmer than the air below, the lower, colder air cannot rise. It is trapped within the inversion layer together with all the pollutants it may contain. Such inversions normally form overnight when the earth cools down and so exist at ground level and, on the Highveld, up to about 300 m. However, inversions of temperature may also form at higher levels.

Inversions are described in terms of their depth and strength. Depth is the distance from the bottom to the top over which the temperature is inverted. Strength is temperature range measured as the difference between the bottom and the top of the inversion. Winter surface inversions range from less than 300 m to more than 500 m, with an average strength of 5 to 6°C. Summer surface inversions have a similar depth but the inversion strength is only about 2°C. Like all other atmospheric phenomena, inversions change shape and strength over time.

The Highveld climate also encourages the formation of elevated inversions: up to five such elevated inversions, layered on top of each other, may occur within the first 1 000 m above the surface. These elevated inversions occur "on 60% of all days at a mean (average) height above ground of 1 700 m, with a depth of just under 200 m and a strength of 1.5°C" [Tyson et al, 1988: 26]. This is often higher than the mixing layer – where the air is active and pollution may be dispersed – with the result that pollution accumulates beneath these higher level inversions and spreads out between the layers. It comes to ground later as acid rain or dry acid deposition.



These figures are put into perspective by the experiences of Kleinbooie Mahlangu whose family and neighbours were subjected, on a daily basis, to “unbearable dust” from mine haul roads and blasting in the Wonderfontein area [see Part 1: 8; 125].

The contribution of spontaneous combustion has never been quantified, although the emissions are known to be highly carcinogenic, as discussed in Part 1 [15]. The Woestalleen shack settlement, occupied by workers and people looking for work, lies between the Hendrina power station and the sprawling Optimum mine complex. People said that a peculiar smell drifts in, mostly in the afternoons, and leads to headaches. The source is one of Optimum’s large discard coal dumps which is burning deep within. The smell is unmistakable: an acrid, smoky, chemical smell.

In 2007, Pone et al warned that the releases from spontaneous combustion on coal heaps were dangerous to health and should be investigated. The fumes contain sulphur compounds laced with heavy metals, including mercury, lead and arsenic. Benzene, toluene and xylene – known to cause cancer – are also present in high concentrations [Pone 2007]. In 2012, this urgent warning was repeated [Banks et al 2012].

The HPA AQMP also acknowledges its importance because of the high volumes of coal mined and indications that “the resulting fires from spontaneous combustion are a very significant emitter of air pollutants on the Highveld”. It promises that “this source category will be included in the AQMP as an area for further research and action to ameliorate the impacts” [DEA, 2011: 39]. It notes that an earlier Mpumalanga Province State of Environment Report [DACE 2001] estimated SO₂ emissions from continuously smouldering coal heaps at more than 54 000 tonnes per annum.

In 2017, however, we heard from an expert that nothing had come of plans to investigate emissions from spontaneous combustion. Hence, these pollutants are not quantified or managed in the HPA AQMP.



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Table 4: Highveld emissions as per HPA AQMP, arranged according to PM₁₀ contributions (tonnes per year)

Source category	PM ₁₀	%	NO _x	%	SO ₂	%
Mine Haul Roads. Kick up dust locally.	135 766	49	-	-	-	-
Primary Metallurgical. Smelting, refining, steel making.	46 805	17	4 416	0	39 582	2
Power generation. Eskom, Sasol. Unrestrained on SO ₂ .	34 373	12	716 719	73	1 337 521	82
Household fuel burning. Coal, paraffin, wood.	17 239	6	5 600	1	-	-
Clay brick manufacturing	9 708	3	-	-	9 963	1
Biomass burning. Wood.	9 438	3	3 550	0	-	-
Ekurhuleni Industrial (incl. Kelvin CFPS).	8908	3	15 636	2	25 772	2
Petrochemical.	8 246	3	148 434	15	190 172	12
Motor vehicles.	5 402	2	83 607	9	10 059	1
Secondary metallurgical.	3 060	1	229	0	3 223	0
Mpumalanga industrial.	684	0				

Source: HPA AQMP, Executive Summary [2011: 4].

Tall stacks and looping plumes

Eskom's response to this unfavourable meteorology was to build tall smokestacks. Table 5 gives the stack heights of various Eskom plants and shows that not all of them emit at a higher level than the known winter inversions – 280 to 300 m – even taking into account plume buoyancy lifting them another 20 to 50 m. And none of them emit beyond the higher inversion layers.



Table 5: Eskom Highveld power stations' stack heights (metres).

Source	Arnot	Camden	Duvha	Hendrina	Kendal
Stack Height	195	155	300	155	275
Source	Matla	Tutuka	Komati	Kriel	Majuba
Stack Height	275 & 213	275	220	213	250

Source: Pretorius [2015: 25].

But even plumes from high stacks can be brought to ground as a result of local convection winds. These are updrafts of hot air during day time which induce downdrafts in air cells next to them. Thus, depending on wind conditions and time of day, a number of plume patterns are possible, as shown in Figure 1 and explained in Box 3.

At Sasol's Secunda plant, there are two power station stacks with a similar height to Eskom stacks. But Sasol's five other stacks are appreciably lower. They release an extraordinary range of pollutants besides particulates, SO₂ and NO_x. They include a cocktail of many VOCs, hydrogen sulphide, hydrogen fluoride, ammonia, hydrogen chloride and sulphuric acid. And emissions of metals include lead, arsenic, antimony, chrome, cobalt, copper, manganese, nickel, vanadium, mercury, cadmium and thallium [Burger et al, 2014]. Added to these smokestack emissions are fugitive emissions from dumps and settling ponds, as well as pollutants released during accidents or 'upset conditions'.

Sasol's Secunda complex thus releases its many pollutants on various levels. The low-tech groundWork bucket brigade found a cocktail of VOCs and sulphur compounds at ground level while high-tech sampling by SAFARI 2000 found the same pollutants at elevated levels.

Dance of the pollutants

As pollutants enter the atmosphere, they interact with other pollutants and elements in the air to form secondary pollutants. Sulphur dioxide, for example, combines with oxygen to form sulphates while nitrogen interacts with oxygen and other chemicals to form ozone. Some molecules connect to small pieces



Box 3: Plume shapes

Plume shapes are useful to citizen scientists as they indicate where the pollutants go, and why. Plumes leave from a narrow point at the stack. As they encounter the atmosphere, they expand and change shape in response to the dynamics shaping the atmosphere at that moment.

Fanning: Frequently at night time, the plume may be trapped or sandwiched between ground level and elevated inversions, as often occur on the Highveld, and spread only horizontally in a flat layer. This leads to stagnant, concentrated pollution. **If plume density is similar to air, it travels downwind at approximately the same elevation.**

Coning: Later in the morning, the surface air warms quickly and the air becomes more lively as the ground level inversion gradually disappears. The coning plume spreads in three dimensions as it lifts upwards. **Pollutants travel fairly long distances before reaching ground level in significant amounts.**

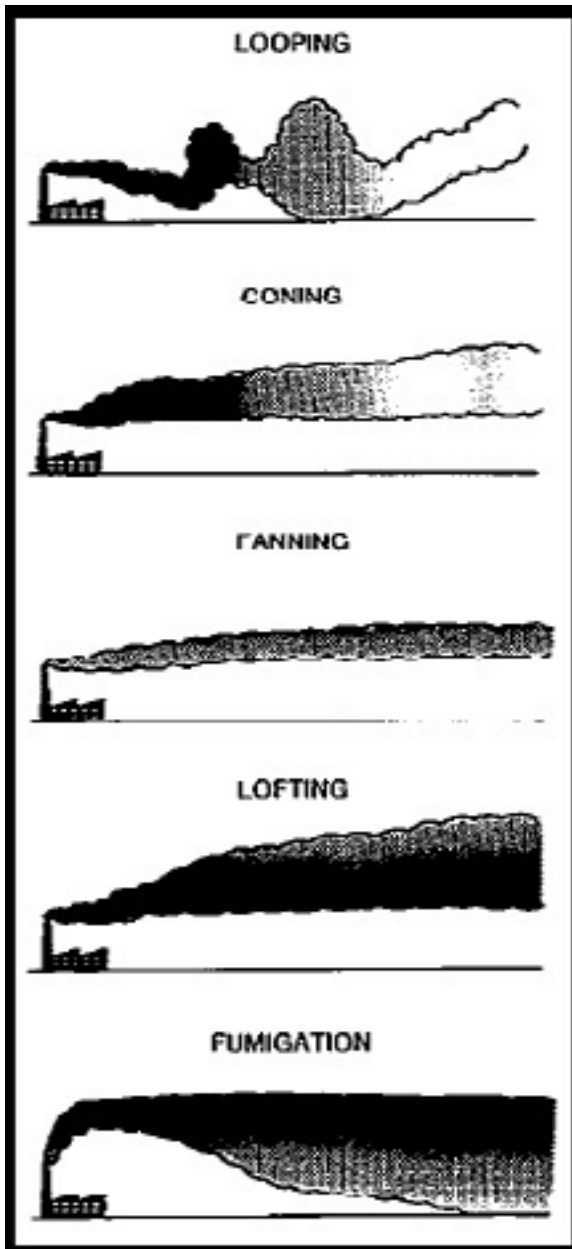
Looping occurs after the ground surface has heated to increase atmospheric stability (typically mid day), causing light to moderate winds, and rising and sinking air, which in turn cause the smoke to move up and down in a wavy pattern and to spread into three dimensions. Pollutants in a looping plume can reach the ground. **High probability of high concentrations sporadically at ground level, close to stack.**

Lofting occurs when conditions are unstable above an inversion. The plume disperses without noticeable effects on ground level concentrations around the source. **Fewer impacts at ground level. Pollutants go up into environment.**

Fumigation takes place when unstable (mixing) conditions occur underneath an elevated inversion layer, such as often exist on the Highveld. Downdrafts in this situation can pull the plume and its pollutants downward to the surface, resulting in high ground level concentrations. A night fanning plume (see above) could turn to a fumigation plume in the early morning. **Most dangerous plume: contaminants are all coming down to ground level.**



Figure 1: Diagram of plumes



Source: Tyson et al 1988.

Sources: Tyson, 1988: 32 onwards, and figs 30 and 31, p. 33; plus online resources accessed 2 September 2017: National Programme on Technology Enhanced Learning (NPTEL), course material on line.

[http://nptel.ac.in/courses/105102089/air%20pollution%20\(Civil\)/Module-4/1.htm](http://nptel.ac.in/courses/105102089/air%20pollution%20(Civil)/Module-4/1.htm) (for quotes in bold describing polluting effects) and Universidad del Pais Vasco. OpenCourseWater lecture notes. https://ocw.ehu.eus/pluginfile.php/12278/mod_resource/content/1/03_Lecture_notes_Air_pollution_technologies_Lesson_03_OCW2016.pdf.

Also see fig. 2. below.



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Table 6: Sasol Secunda stack heights (metres)

Stacks	Secunda coal fired power stations	Superflex Catalytic Cracker (SCC) Main	Wet Sulfuric Acid (WSA)	Multihearth Biosludge Incinerators East and West (x2)	High Organic Waste (HOW) Incinerator East	High Organic Waste (HOW) Incinerator West
Height	301 & 250	90	75	30	15	15

Source: Burger et al [2014]

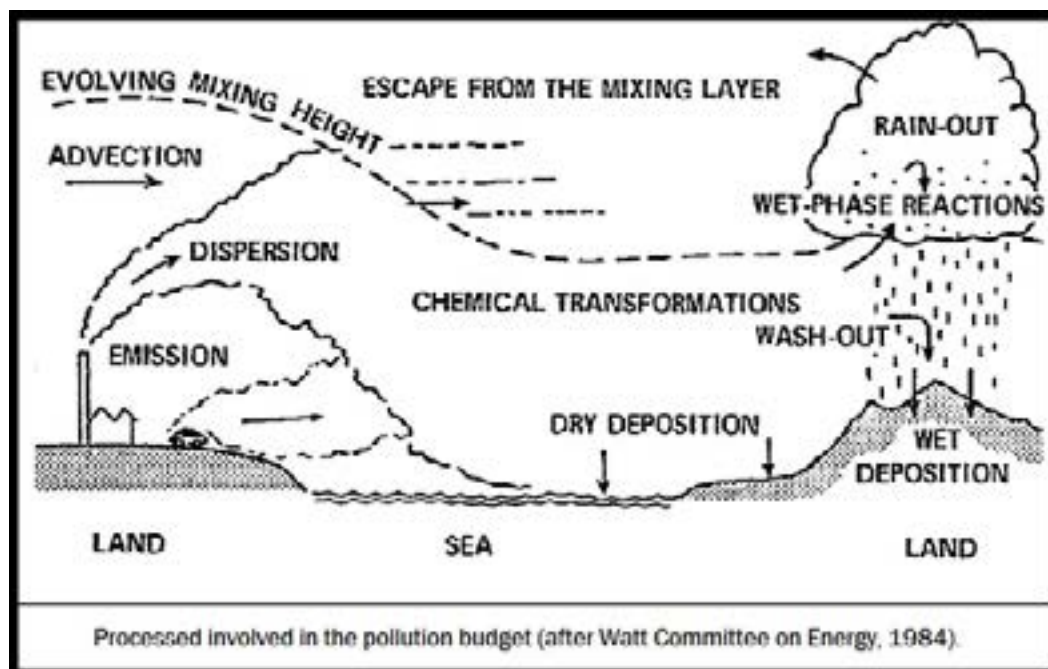
of dust or other particles. This influences how heavy they are, which in turn determines how long they stay in the atmosphere. Pure sulphur dioxide, the sulphurous gas, may stay in the atmosphere for a couple of days. The gas may be transported – by wind – to other areas close by or to another continent a whole ocean away. Some pollutants may be diluted to such a small concentration that they are no longer of concern to air quality managers. While dilution does not remove pollutants from the air, pollutants are removed through wet or dry deposition. Pollutants may be washed out by rain – they interact with raindrops in different ways – or may come down to earth through gravity – the heavier ones fall faster, the lighter ones are more easily blown back up again.

Monitoring at Amersfoort, southeast of the major polluting sources, has recorded high levels of ozone, indicating that it is formed from precursors (SO₂, NO_x and VOCs) emitted in Secunda some 80 km away.

There are two main modes of transport for elevated pollutants over the Mpumalanga Highveld. First, an estimated 45% of pollutants are transported out of the area in three directions: towards the Indian Ocean, the South Indian Ocean and the Atlantic Ocean. Second, 33% of pollutants are recirculated over the sub-continent, including the Highveld, returning to the point of origin [DEA 2011]. So a large part of the pollution that blows away, comes back again. The Highveld also ‘imports’ pollution from the highly polluted Ekurhuleni urban centres and even from Zambia’s copper mines and smelters.



Figure 2: 'What goes up, must come down'. Processes of chemical transformation and transport that pollutants may undergo between being emitted and coming to ground.



Source: Tyson et al, 1988.

Mercury

One result of this pattern is the export of mercury from Eskom and Sasol. Coal-fired power stations are the main source of mercury emissions in South Africa. Masekoameng et al estimated emissions to air at between 27 and 39 tonnes a year with another 6 to 7 tonnes going into waste ash [cited in Pretorius, 2015]. Eskom researchers Garnham and Langerman [2016] give a lower estimate of 17 to 23 tonnes a year emitted to air in 2011 to 2015. Either way, South Africa is one of the largest emitters of mercury in the world.

In 2015, the DEA allowed Eskom to postpone compliance with minimum emission standards (MES) but required an emission reduction plan. Garnham and Langerman predict that "on completion of Eskom's emission reduction plan, which includes fabric filter plant retrofits at two and a half stations



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and a flue gas desulphurisation retrofit at one power station, total mercury emissions from the fleet will potentially be reduced by 6 to 13% by 2026” [2016: 14]. That would leave emissions of between 14.8 and 21.6 tonnes a year which still seems like rather a lot. Nevertheless, the implication is that, by allowing the Minimum Emissions Standard (MES) postponement – see below in this chapter – the DEA is also allowing Eskom to continue emitting mercury, much of which will land in the sea.

When mercury lands in water – in rivers or the sea – it is methylated. This changes its molecular form to that of organic mercury which can be taken up by living beings. It then bio-accumulates as it moves up the food chain, becoming highly concentrated in predator fish like tuna. People can then ingest large and harmful amounts of mercury when they eat such fish. Many coastal people who depend on fish as an essential part of their diet are thus put at risk.

Acid Rain

‘Acid rain’ is formed by the wet deposition of both sulphates and nitrates. In Europe, in the 1960s and 1970s, this was recognised as a big environmental problem as forests died back and fish stocks declined. This provoked a strong interest in environmental politics in Europe and led to the formation of the Green movement in Germany. The science also showed that the tall stack solution to SO₂ emissions was not working – it simply spewed out the sulphur high enough to be carried to other areas, often across national borders. This made acid rain a topic of diplomatic negotiation and lots of media reports.

While the public became impatient with delay, there were many scientific debates about the exact mechanisms which caused the forest deaths – although the impact on the forests themselves was not in question. The concept of ‘critical load exceedance’ was developed in the 1980s. It identified the point at which the inherent capacity of the soil to neutralise the added acid was exhausted and the continued acid deposition started to have adverse effects on the eco-system. This approach resolved many scientific and political issues, as it no longer required an understanding of every aspect of the pollution impacts before action could be taken to deal with the problem [Demb 2001].



European regulation then led to a reduction of SO₂ emissions of 76% between 1990 and 2009, as energy producers were required to switch from high sulphur-containing solid and liquid fuels to low sulphur fuels and to fit flue gas desulphurisation (FGD) technology in industrial facilities.³³ More recently, however, European emission controls on sulphur seem to be falling behind developments in China, Japan and the US [Myllyvirta 2015].

In 1988, Tyson et al noted that acid deposition through acid rain was occurring on the Highveld, but questioned whether this constituted an environmental problem. Even in 2002 researchers funded by Eskom could still argue that

...the economic impact of fitting control technologies to limit the emissions of acid precursors such as sulphur dioxide and oxides of nitrogen to the atmosphere are potentially very large. It is thus essential that the need for such controls be adequately demonstrated before industry commits itself to any action. Such a demonstration requires a detailed understanding of the mechanisms involved in acidification and the time that it will take for ecosystem responses to develop ... [Galpin and Held 2002: 334]

Their work did not provide such a demonstration and Eskom continues to emit vast quantities of SO₂ while resisting pressure to install control measures. In the meantime, the processes of acid deposition via acid rain and dry deposition continued to build up. In 2011, a team of researchers reported on soils sampled over two years and found that there was a high exceedance of 'critical load' for surface deposition – in other words, more acid had been deposited than the soil could absorb without turning acidic – “in the western and central Highveld industrial region and adjacent area to the north” and “several smaller areas located downwind from major sources showed exceedance, although the levels of exceedance were low” [Josipovic et al 2011:8].

The test site that showed the highest amount of soil acidification was at Elandsfontein, an Eskom monitoring station near the Kriel power station.

33 European Environment Agency, <https://www.eea.europa.eu/data-and-maps/indicators/eea-32-sulphur-dioxide-so2-emissions-1/assessment-1>, <https://www.eea.europa.eu/data-and-maps/indicators/eea-32-sulphur-dioxide-so2-emissions-1/assessment-1> accessed 14 August 2017



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Being “at the centre of the industrial Highveld, [it] had ... an overall total acid deposition of 23.3 kg/ha per year for the first year and 15.8 kg/ha for the second year. Sites downwind of the industrial Highveld (Site 1, Standerton and Site 2, Amersfoort) had the second highest cumulative deposition results for both annual cycles” [2011:5]. If the Elandsfontein acid deposition is multiplied by a period of 50 years, it would amount to around 950 kilograms per hectare.

It is now recognised that agricultural soils and ecosystems are not only at risk but are, in some places in the polluted vicinity of Eskom power stations and Sasol Secunda, already heavily affected. Soil acidification is a long-term process and not reversible. By 2016, a group of researchers [Conradie et al 2016] found much higher acid rain, with clearly increasing acidity in rainwater. The soil in the industrial/agricultural area is now recognised to be at risk, and concern has been expressed by Mpumalanga farmers who have found it necessary to add supplements to their livestock feed to counteract it.

Water from everywhere to burn coal

Extensive infrastructure has been built to provide for the needs of Eskom, a parastatal, and Sasol, a private company. It amounts to a large taxpayers’ subsidy to dirty coal.

Eskom’s power stations use massive amounts of water. In 2011, Eskom used 327 billion litres of water per year and Kusile will use another 26 billion m³ per year [Greenpeace 2012]. The majority of the water is used in internal steam cycle and cooling processes. Other uses are water purification, carrying away ash slurry, operating pollution control devices and dust suppression. This use is in addition to the impacts of coal mining and transport [see Part 1]. This is not an insignificant amount. While official statistics say that the electricity sector uses ‘only 2%’ of South Africa’s water supply compared to 3% for industry, if coal extraction and washing is included, the electricity sector’s share of water use more than doubles to 4.84%, as Wassung argues [2010]. And that does not count the water polluted by coal mining and air pollution.

A typical large 3 600 MW power station requires 45 billion m³ of water per annum. Most of the water for Eskom’s power stations on the eastern side



of Mpumalanga is supplied through a complex network from dams such as Nooitgedacht and Vygeboom in the Komati catchment, according to Van Rooyen and Van Jaarsveld [2010]. They note that the Department of Water Affairs (DWA) put Eskom under pressure to reduce water use and it now uses dry cooling at Matimba, Kendal and Majuba, as well as at Kusile and Medupi. Approximately 131.5 million m³/a is transferred from the upper Komati to the Olifants River Basin, 104 million m³/a of which is for Eskom.³⁴

The large coal-to-liquid plants, Sasol 2 and 3 at Secunda, use around 90 million m³ of water per year. By 2004, these water transfers were no longer enough, and the VRESAP (Vaal River Eastern Subsystem Augmentation Project) was built in order to deliver water from the Vaal Dam over a distance of 115 km. The pipeline has a design capacity of 5.4 m³ per second and pumps water upstream. As then water minister Lindiwe Hendricks explained in 2009, Sasol needs 11.5 litres of water to produce 1 litre of petrol, and Eskom requires 1.5 litres of water for every kilowatt hour of electricity they produce. And, whereas clean water will be delivered from the Vaal Dam, increasingly dirty water will be returned to it.³⁵

How is the water used? The Water Use Licence (WUL) application for Duvha power station provides an illustration of a coal-fired power station's water needs (see Table 7).

Ash

Power stations also produce mountains of ash consisting of:

- fly-ash, including PM₁₀ captured from stacks by emission control equipment, in Eskom's case Electrostatic Precipitators (ESPs) or bag filter systems;
- bottom-ash, collected from the furnace grate; and
- other pollutants captured before emission.

34 <http://www.dwa.gov.za/IO/Docs/CMA/CMA%20GB%20Training%20Manuals/gbtrainingmanualchapter5.pdf>

35 <https://www.dwa.gov.za/Communications/MinisterSpeeches/2009/MinisterspeechVRESAPFunction1April2009V2.pdf>



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Table 7: Duvha power station water use

Category	Source	Minimum demand	Maximum demand
Potable water (excluding 3 rd parties)	Raw water	5.0 MI per day	9.0 MI per day
Demineralised water (for use in steam cycle)	Raw water (very clean water from Komati transfer, highly purified)	1.0 MI per day	3.0 MI per day
Cooling water	Raw water Dirty storm water (when available and of good enough quality)	70 MI per day	175 MI per day
Ashing system (Ash water)	Water treatment effluents Dirty storm water (when storm water is available and of good enough quality) Cooling water blow-downs	43 MI per day	65 MI per day

Adapted from Duvha WUL application 2003: 26

Eskom’s power stations consume about 120 million tonnes of coal per annum and produce over 30 million tonnes of ash. Eskom says, “A modern coal-fired power station with a total output of 3 600 MW will consume around 50 000 tonnes of coal every day. Depending on coal quality, the heat and ash content, stations can produce around 17 000 tons of ash per day”.³⁶ That adds up to six million tonnes a year and an ash dump of 248 million tonnes after 40 years.

Eskom’s ash is mixed with water to make a slurry which can be piped out of the power station to the mountainous ash heaps. As far as we can ascertain, none of the Eskom’s ash heaps are lined. Duvha’s WUL seems to assume that its ash dam is leaking and will leak into the groundwater, but proposes no

³⁶ <http://www.eskom.co.za/AboutElectricity/FactsFigures/Documents/CO0004AshManagementRev12.pdf>



mitigation measures.³⁷ Petrik [2004] noted that “trace elements (arsenic, boron, lead, nickel, selenium, strontium, vanadium and zinc) are found in higher concentrations in fly ash relative to coal and soil”. He continued:

An analysis of Eskom fly ash material has shown that many contaminants are present... This makes landfill a poor option and there is no secondary use large enough to reduce the quantity of ash effectively. The wastewater in the slurry, as well as rainfall, leaches out toxic metals, anions and cations (i. e salts) from the ash heap. This caustic, alkaline leachate contains high concentrations of hydroxides, carbonates and sulphates and precipitates minerals such as iron oxides and sulphates... Water and soils are contaminated and large areas of precipitates mar the environment around ash heaps, which are also the source of corrosive airborne particles. [Petrik, 2004: 8].

This research, supported by Coaltech, nevertheless found that it was feasible to treat acid mine drainage with fly-ash and to develop a sellable recycled product from it. In fact, Eskom already sells approximately 1.2 million tonnes of ash per year to the cement and construction industries. It is used as a cement extender, concrete enhancer and for making bricks. Eskom says that approximately 250 000 tons of ash from Lethabo power station were exported to Lesotho for the Katse Dam project.

A similar strategy – of declassifying coal ash from toxic to recyclable waste – by the US Environmental Protection Agency (EPA) has led to ongoing controversy in the US. In 2012, the EPA commissioned a study³⁸ which, as the Physicians for Social Responsibility (PSR) reports,

... found that living next to a coal ash disposal site can increase your risk of cancer or other diseases, especially if you live near an unlined wet ash pond that contains coal ash comingled with other coal wastes

37 See for example Duvha WUL p. 24: “The boreholes in the areas downstream from the ash (B1, B2, B3, B4 & B5) show various degrees of groundwater pollution. Pollution levels and constituents vary according to distances from the ashing facilities.”

38 The 2007 draft EPA study, which is “not for quotation”, can be found at <http://www.southeastcoalash.org/wp-content/uploads/2012/10/epa-coal-combustion-waste-risk-assessment.pdf>



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and you get your drinking water from a well. According to the EPA's peer-reviewed "Human and Ecological Risk Assessment for Coal Combustion Wastes" people in those circumstances have as much as a 1 in 50 chance of getting cancer from drinking water contaminated by arsenic, one of the most common and dangerous pollutants in coal ash. This risk is 2 000 times greater than the EPA's goal for reducing cancer risk to 1 in 100 000. That same risk assessment says that living near ash ponds increases the risk of health problems from exposure to toxic metals like cadmium, lead, and other pollutants. [Gottlieb et al, 2010: vii].

The PSR explains that toxic metals in coal ash, especially in the case of prolonged exposure "can cause several types of cancer, heart damage, lung disease, respiratory distress, kidney disease, reproductive problems, gastrointestinal illness, birth defects, impaired bone growth in children, nervous system impacts, cognitive deficits, developmental delays and behavioural problems. In short, coal ash toxics have the potential to injure all of the major organ systems, damage physical health and development, and even contribute to mortality" [Gottlieb et al, 2010: vii].

The increasing practice of mixing in other pollutants, including mercury, that are scrubbed from emissions of coal fired power stations with the coal ash increases the risk. Ironically, as air emission standards become stricter, more toxins are put into the ash. When ash is placed in unlined heaps – as is the case in most ash heaps in South Africa – these toxins leach into the water.

In the US, however, under pressure of intense lobbying from the coal-fired power station industry, the EPA in 2014 disregarded the study's evidence of harm to people and ecosystems and declared coal ash a non-hazardous waste, enabling it to be recycled in large quantities. But ash dumps remain a massive liability. In August 2017, in terms of the Clean Water Act, a US court ordered the removal "to a safe, dry, lined location" of ash dumps in Tennessee that are polluting underground water in a karst (dolomite) area.³⁹

39 <https://www.southernenvironment.org/news-and-press/press-releases/victory-for-clean-water-and-communities-in-coal-ash-law-suit-against-tva>



Box 4: Living in the shadow of an ash dump

The Phoku family lives near Pullen's Hope in the shadow of the Hendrina Eskom power station's massive ash dump. To reach them, Rika Phoku guides the research team on a dirt road around the dump which rises like a low table mountain above the landscape. The lower slopes are grassed. The upper slope is ash grey. This is 45 years' worth of ash.

We also pass pipes gushing huge volumes of water into a drain. This is the system returning water to the ash management section inside Hendrina. Ash is mixed with water and pumped in a slurry pipeline to the top of the ash dam. The drainage system then gathers the water to be returned to the plant. A little lower in the valley, outside the ash dam fence, are what look like two evaporation dams. They are an unnatural bright blue. They are Eskom's dams but the Phokus do not know their function.

Rika Phoku's parents are in their 90s and she would like to live with them. But the bus service into town no longer runs and she can't get to work in Pullen's Hope, the power station's village, from the farm. There is also no transport to get them to hospital when need arises. The family have been here 40 years. Her father worked at Eskom and at Spoornet before they came to the farm. The farmer died recently and his wife does not live there now. The family is in dispute with the foreman who is demanding outrageous grazing fees for their cattle.

When they arrived, the ash dump was small and not fenced. Now it towers above them. It is not so bad in summer as the rain keeps it wet but in winter, say the Phokus, the ash blows off the dump in thick white clouds. "You can't go out when it blows. And it comes into the house and blocks your eyes, nose and mouth. The dust makes you cough – sometimes a dry cough, sometimes a wet cough." The public clinic only tests for TB. If something else is wrong with people's lungs, they cannot tell. Rika's brother, Johannes, had asthma and died at 45. He worked at Eskom Hendrina. Then his eyes got sore and they transferred him to work on the ash dump. But the dust affected him badly. They have masks but that did not help. When he could not work any more, he lost his job.



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At that time, management did not worry about dust. They just told him to go to the clinic. People are still dying. Just a month ago, the Phokus went to the funeral of someone with the same symptoms as Johannes. Another ash dump worker gets mouth ulcers and sore eyes. But people are scared to talk about it because they think they'll be chased off.

The household gets water piped from Eskom. Previously they had their own well which her father dug. But Eskom's ash dump manager told them the water was not right. Recently, the water was turned off for several weeks. This appeared to be retaliation for calling on the Centre for Environmental Rights (CER) to help them in a complaint about the dust. That provoked a further complaint and the water was turned on again. They also struggle to get electricity. The council promises to come but doesn't. They use a generator for lights but Rika has to keep food for the family in her fridge in town.

There are three mines across the valley from them: Tumelo underground mine – which is closed; Klipbank, also underground; and Optimum which is open cast. The main impacts are from Optimum. When they blast, a thick dust blows across the farm. Sometimes they are showered with rock rubble – enough to puncture the roof. And the cracks are bad – they have rebuilt parts of the house three times.

'Adequate control'

The researchers who argued that the Highveld was one of the worst places to spew large scale pollution into the air, also warned of the health consequences. In 1975, air pollution control fell under the Department of Health and it placed a curb on the building of any further large coal-fired power stations in the area for this reason.

However, this policy was “revised so that industries which are based on large scale consumption of coal may be established in the area, provided adequate control is applied to particulate and gaseous sulphurous emissions” [Tyson et al 1988: 2]. This section looks at whether such 'adequate control' was ever achieved in the furious building spree of some of the largest coal-fired power



stations in the world (weighing in at 4 000 MW each), many of them in close proximity to each other, as well as the establishment of the Sasol Secunda twin petrochemical plants, and a number of other coal-burning industries. It looks at the original power relationship which was established between polluters and the regulator since the 1950s, and the results of that under the APPA. It then follows the activist-led fight for new and stricter legislation, including ambient air and emission standards, the development of pollution hotspots and the declaration of pollution Priority Areas. It ends with a discussion of current initiatives by big polluters in the Minerals-Energy Complex to circumvent regulation through postponements of minimum emission standards and the use of offsets.

Careful not to burden industry

The history of air quality management in South Africa reaches back to the formulation of the APPA of 1965. In 1952, international attention to air pollution intensified following a killer smog in London. In 1953, Durban experienced an industrial smog crisis but could not identify the sources or deal with them in terms of the limited legislation available [Singer 2011]. Both incidents caught the attention of Eric Halliday at the CSIR, who encouraged the Department of Health to appoint the first National Air Pollution Committee in 1955 and organised the first conference on air pollution in South Africa [Boegman 1979].

Following on from the committee, a Commission of Inquiry produced a bill based on British and US legislation. The commission included representatives from the Health Department, the CSIR's National Physical Research Laboratory, the South African Railways, the City Council of Durban, the Department of Mines and the Government Mining Engineer. The Report of the Commission, quoted by historian Michal Singer, emphasised that the draft bill provided "for the recognition of the interests of industries, the mining industry and local authorities in connection with the administration of the Act". Singer reports that:



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The Commission of Inquiry had been adamant that in the promulgation of the bill, control would be “secured by agreement rather than compulsion”. Most important was to show that atmospheric pollution could be controlled in the “selected areas... and that the cost of such control (would) not cripple industry or the local authority”. This would necessitate the cooperation of state, provincial and local authorities and various industrial role players. After all, private industry was “saddled with a burden” in having to gain approval from several authorities when embarking upon endeavours that could pollute. [2011:60].

She argues that at the time, “[T]his had the result of creating tremendous mistrust between state and civil society as the Department of Health gave ‘the impression of protecting bad polluters from the public rather than the other way about (sic)’” – as expressed by environmental journalist James Clarke [1974:47]. This mistrust has continued to the present day.

Halliday – who became the first CAPCO – created the framework in South African air pollution control in which polluters would be treated with kid gloves. In a 1967 address he advocated a policy of compromise, arguing that

... the important thing (was) if possible not to get to the Court Case... it means you’ve failed. An Inspector who gets to that stage has lost his friendship and now has got a real enemy and is in big trouble. If you can persuade, push or encourage the industrialist to reduce his smoke output without a Court order, he is doing very much better [quoted in Singer 2011: 80].

This reflected a power relationship between polluter and regulator that has lasted to this day. Halliday explained that the strength of industry, the prominent role of coal as well as uncertainty about pollution control methods were the factors that made enforcing air pollution legislation difficult.

Another enduring characteristic of South Africa’s air quality management system laid down at this early stage was the wide discretion built into the personalised role of the CAPCO. It depended crucially on his (all were men)



knowledge of pollution abatement technologies, which had to match that of industry engineers and managers, because of the principle that control would be limited to reasonable technical remedies. Of course, this discretion played out in the context of maintaining friendly relationships with the polluters under regulation.

Further features included the ongoing debate about a division of responsibilities between national officials (then in the Department of Health) and local authorities. The latter were made responsible for smoke but not emissions from industry. There was early concern about the lack of experienced personnel to deal with air pollution. And a politics of making industry information secret characterised the APPA system from the start. This pattern has also survived into the present.

One major critique of the Act was the way in which it conceived industry: ‘scheduled’ industry was generally understood to be “carrying out certain processes... mostly producing strategic materials which involve(d) a certain amount of secrecy”. Such prescriptions made monitoring and reducing smoke emissions difficult. [Singer 2011: 81, quoting Halliday].

“Minimum requirements for safeguarding health are mandatory”

Halliday’s successor as CAPCO was Nico Boegman, a student of Halliday, and himself a teacher to a whole generation of South African air quality researchers and professionals. In 1979, Boegman published his PhD, “The Development of a National Policy for the Control of Air Pollution in South Africa”.⁴⁰

Boegman warned that the poor dispersion potential of the Highveld should be taken into account, that the arid South African climate would not permit extensive use of wet scrubbing of pollutants because of its demand on water sources, and that pollutant removal by rain would be much less than in the wet

40 The thesis provides overviews of the extent of pollution, British and US legislation and implementation histories, and appendices on emission control needs and technologies in different industries.



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countries of Europe. Boegman argued for ‘flexibility’ which he found in the approach of ‘best practical means’, which should include “the state of available technology, the cost of implementation and above all the health of man” [1979: 57]. He emphasised that the best practical means should not be defined by industry and that flexibility should include increasingly strict standards as new technology became available.

Boegman wrote that “minimum requirements for safeguarding health are mandatory but beyond that point cost must be the deciding factor in abatement policy formulation” [102]. But what is that point? The drafters of APPA avoided a health definition, according to Boegman, because it would be difficult to prove harm to health, and “it could easily be argued that only the purest air will satisfy the requirement of ‘necessary for the protection of any section of the public’” [101]. In sum, both the health of the population and what would be reasonable pollution control measures were left to the discretion of officials who, as Halliday had emphasised earlier, should do everything in their power to maintain good relationships with the polluters. He continued:

In summing up the determination of best practicable means, it can be said that a scale has been established on which a concentration of pollutants at one-fiftieth of proven Threshold Limit Values marks the absolute minimum control requirements. The other end of the scale is at a point near zero pollutant concentrations ... Within this scale, it is the duty of the Chief Officer to progress stepwise and with caution to a point of maximum marginal return on investment as defined by the marginal benefit concept. [113].

APPA required that all scheduled processes – processes with significant air quality implications – should have registration certificates. These certificates typically specified “... emission concentrations without limits on volumetric flows or on total masses of emissions.” [Scorgie 2012: 184]. The APPA regime lasted nearly 40 years, from 1965 to 2004 when the AQA was passed.⁴¹ At the

41 Some aspects of APPA regulation remained in place transitionally, until 01 April 2010 when the full measure of AQA controls was introduced, and some of the early thinking about air quality under APPA survives into the present.



end of this period, APPA was judged harshly. The following criticisms appear in a review by Naiker et al [2012]:

- APPA used an out-dated approach and lacked proactive air quality management – it did not set and pursue clear goals for a desired ambient air quality;
- The core strategy of ‘best practicable means’ was biased towards industry as it meant closed negotiations between government and industry;
- APPA did not result in technology innovation;
- There were no emissions standards;
- The penalty system was inadequate in deterring pollution;
- It was poorly enforced and guideline values could not be legally enforced.

In the end, it scarcely inhibited the development of air pollution hotspots and it met with sustained challenges from civil society looking to find a new system that reflected people’s right to an environment that did not harm them.

The fight for clean air and environmental democracy

True to the spirit of environmental justice, groundWork director Bobby Peek identifies the root of South Africa’s bad air quality management in the explicitly racist industrial geography of the segregated city, which started in Durban in the 1930s, and was intensified and extended country wide under apartheid:

Dirty industry and the toxic pollution that came from it was officially placed in areas where black people lived. The blueprint for a black neighbourhood was a waste dumpsite, where waste from rich white neighbourhoods and dirty industry was dumped, a sewage plant, and dirty industry that provided toxic jobs for an expendable black workforce. [Peek, 2014: 16].



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Under apartheid, such views were silenced in the pervasive repression of black people and black opinion. With the growth of the environmental justice movement since the late 1980s, and in the more allowing public spaces after 1990, resistance against environmental racism intensified.

The first big mobilisation of people against air pollution attended the visit to south Durban of then president Nelson Mandela, in March 1995, where he was to open an expansion project at the Engen refinery. He was greeted by people from all the south Durban communities as they collectively expressed their vehement opposition to the expansion. The encounter hastened the formation of the South Durban Community Environmental Alliance (SDCEA) as activists realised how many of them were scattered across the segregated communities.

One of the community demands in 1995 was that the two big Durban refineries, Engen and Sapref (owned by BP and Shell), should reduce SO₂ pollution by 80% over five years. Engen agreed in principle and, after much stalling and further negotiation, signed a Good Neighbour Agreement with SDCEA in 1999. SDCEA and Engen then presented the agreement to the CAPCO who wrote it into Engen's permit. Engen thought SDCEA would rest on this achievement but, when the Bucket Brigade picked up high levels of VOCs and benzene on the fenceline, SDCEA went after Engen again. Peek concludes: "Seventeen years later we still do not have online fenceline monitoring. This experience confirmed the hollow promise of industry self-regulation."

In the meantime, following a string of environmental incidents, government announced a 'Multi-Point Plan' (MPP) at a public meeting in south Durban. The points included new legislation – later the AQA – with SO₂ standards at national level, toughened up regulation to improve air quality at local level, and a study of the health impacts of pollution in south Durban. These points largely reflected the activist agenda developed over 10 years of campaigning. In the following years, Durban City Health commissioned an air quality monitoring system with 12 monitoring stations continuously measuring SO₂, NO_x, PM₁₀, PM_{2.5}, Ozone and carbon monoxide, as well as Total Reduced Sulphur because of the importance of sulphur compounds in pollution from oil refineries. It also took on the devolved role of issuing APPA permits to scheduled industry.



The two functions were meant to form a coherent regulatory regime to drive a reduction in emissions. The eThekweni air quality management system was seen as so successful that DEA showcased it as a model for future Air Quality Management Plans required by AQA [Euripidou, 2014].

On the national level, however, the first five years of democratic government had completely failed to improve air quality regulation in line with the Constitution and the framework National Environmental Management Act of 1998. As a result, the period 1999 to 2004 was one of intense organisation and resistance to air pollution. As Peek observes:

This five year period was the most active and contested period in the history of people's resistance to corporate air pollution and demands for accountability. The vocal nature of the struggle got the national parliament's portfolio committee on environment and tourism to adopt the language of 'toxic hotspots' which was coined by community groups in their struggle. [2014: 22].

The activism ignited in South Durban spread to Sasolburg and Vanderbijlpark in the Vaal and to the Highveld and combined with others across the country. People were incensed that they and their communities were subject to air pollution in the new democratic South Africa. In July 2002, and informed by the experience of creating new knowledge through the Bucket Brigade, communities gathered for an Air Quality Strategy Workshop in Sasolburg in July 2002. They produced a five-pillar strategy to fight industrial pollution:

- Develop awareness of the impact of pollution on health and rights of people;
- Mobilise communities and organisations locally and internationally around polluting industries;
- Lobby and pressurise government to develop effective policy and legislation and to hold corporations accountable for their transgressions;
- Work with trade unions, government and academic institutions to improve communication and access to information;



Box 5: The importance of VOCs

From the early 2000s, groundWork and community activists were arguing that VOCs were being neglected by regulators. The first South African bucket samples in Sasolburg found a veritable cocktail of chemicals in the air at all sites. Significantly, the 'bucket brigades' found several chemicals on which there was no prior information in South Africa. And they found particularly high readings for benzene at the majority of sites while levels for toluene and xylenes were elevated at some sites.

VOCs are organic compounds – in other words, they contain carbon – which generally have a low boiling point and so evaporate quickly from liquid into gas. Most VOCs are hydrocarbons which are the chemicals at the core of the petroleum business because they drive and lubricate engines. They are also found in a range of other products such as solvents, paints and poisons. VOCs found in the South African buckets included: toluene, 2-Butanone (methyl ethyl ketone), benzene, trichloroethylene, ethylbenzene, m – and p-xylenes, o-xylenes, styrene, vinyl chloride, carbon tetrachloride, methyl chloride (chloromethane), methyl tert-butyl ether (MTBE), 1,2 dichloroethene.

[For a detailed account, see groundWork's Community Air Monitoring Report, 2003].

- Develop communities' own air quality monitoring and research, which will be biased towards people's health and well-being.

When the new AQA bill was put forward in 2003, activists were ready to respond with a detailed set of demands, documented by groundWork [2003]. They said:

The draft National Environmental Management: Air Quality Bill appears to herald a new approach to managing air pollution, which we welcome. South Africa's democratic government has a strong record of developing progressive policy and legislation. Implementing policy and enforcing the law, however, remains a critical challenge. Government



must commit itself to clear time-frames for the progressive and speedy realisation of all the benchmarks indicated below:

- Problems in the Air Quality Bill (identified by civil society) must be corrected before it is enacted.
- The implementation of a new law on Air Quality must be accompanied by at least the following features:
 - Enforceable ambient and emission standards must be set nationally to ensure uniformity and dissuade dirty industry from moving to areas where there is weaker provincial and local government. These standards have to be adjusted (made more stringent) in local areas where industrial polluters operate in close proximity (pollution hotspots).
 - Technology standards must be a critical consideration when making decisions on license applications. Technology must be based on BAT (Best Available Technology)/BART (Best Available Retrofit Technology) principles, with determination as to acceptable cost for technology being based on rational and transparent consideration.
 - Quality control measures must be applied to the testing equipment used during monitoring and a legal test must be used to monitor technology standards.
 - Emission standards must be health-based in accordance with World Health Organisation (WHO) guidelines.
 - Community “right to know” and public involvement in monitoring and information gathering must be included in the Bill.
 - The Bill must indicate what systems should be used by polluters and government authorities for information gathering, such as a Pollution Release and Transfer Registry (PRTR) or a Toxic Release Inventory (TRI).



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- The Bill must indicate how national government will support lesser-resourced local and provincial authorities with pollution monitoring and information gathering.
- Stringent regulation, nationally and at the local level, must be demonstrated through provision for, and enforcement of, sufficiently strong sanctions through prosecutions, fines, withdrawal of licenses, interdicts halting polluting processes, and so forth.
- There needs to be a dramatic reversal of current enforcement capacity trends which have seen the number of enforcement officers dwindle and a reliance on self-regulation by polluters.
- The fiscal implications of a number of these characteristics needs to be reflected in an increased budgetary allocation for pollution control.
- There must be a measurable reversal of declining air quality in South Africa – both nationally and in local ‘pollution hotspots’.

In the face of growing and vocal community pressure, government finally released the Air Quality Bill in February 2004 (near the end of the second democratic parliament). While welcoming the move from APPA, activists specifically demanded [list from Peek 2014: 23]:

- The rejection of voluntary, self-regulation by corporates in the form of ‘environmental management co-operation agreements’.
- A clear reference to health, linking the Bill to the environmental right in the Constitution.
- Mandatory national emission standards aimed at minimising air pollution from industrial sources.
- Time frames to ensure that compliance is achieved with these and other standards in the bill.
- A requirement for clear information systems such as toxic release inventories and pollution release and transfer registries.
- No exemptions



- Officials' discretion should be guided by clear criteria (based on the environment right in the Constitution).

While many of these demands were achieved, says Peek, air emission licences (AELs) are still being held back or released with heavy redactions blacking out information.

In the first five post-apartheid years (1994 to 1999), we used our constitution to demand what we needed, and got it. But as law was written to give meaning to the Constitution, the Constitutional commitments were watered down or access was made more onerous. So, not 22 years into our democracy, industry can withhold information with impunity because our policy, legislation and regulations have given industry more rights than people. This is sad! So the question has to be asked, are our laws constitutional?

Community groups and activists were concerned about the devolution of the responsibility for air quality management to local level, where there was little or no capacity for it, compounded by the lack of adequate mechanisms for support from national and provincial governments which were also poorly resourced.

Significant victories were won before the bill was passed but two important fights were lost and continue to haunt air quality: regulatory authority was devolved to local government; and a loophole was left for the postponement of compliance with minimum emission standards. The Bill was signed into law as the National Environmental Management: Air Quality Act (NEM: AQA) in early 2005.

Activists were thus active in shaping air quality legislation. They remain active in policy debates, on-the-ground monitoring of air pollution, mobilising communities and pushing for more effective government regulation. In the process, a tradition of activist monitoring or citizens' science has developed in response to the discreet and disciplined knowledge of air pollution that is held by a few and, more importantly, has served more to delay than inform action to improve air quality and the health of people in polluted areas.



Box 6: Discreet, discrete and disciplined knowledge

Discreet knowledge is the opposite of public knowledge, although it often takes the place of public knowledge, and may even be produced with public money. It is a knowledge that is careful and prudent not to reveal too much, not to jump to conclusions, not to endanger researchers' networks and funding, especially when that funding is controlled by the big polluters who purposely set out to control what knowledge is created, what is shared and what is kept secret.

It is also discrete in nature: it functions in separate, discrete bits and pieces. It is not integrated, not adding up to a big picture and able to push confident and strong action. Instead it narrows itself to specific disciplines, and keeps its pronouncements in obscure knowledge that is accessible only to those who describe the world in the same disciplinary terms.

The function of discreet knowledge is to keep things out of focus, such as the health impacts of air pollution on the Mpumalanga Highveld, or the extent of acid deposition as a result of uncontrolled emissions of sulphur dioxide from Eskom. It keeps out of focus what the real costs are to people and the health system, and what the extent and significance of externalities are in producing energy from fossil fuels. It works to reinforce the superior knowledge and decision making influence of the big polluters.

Setting standards

The next battle was to get government to set national standards for ambient air and for emissions from polluters. The APPA regime had dealt only with the control – such as it was – of emissions from registered sources. How these emissions added up to ambient air quality was not dealt with under APPA.

Setting ambient and emission standards was an early objective of civil society, dating back to the Consultative National Environmental Policy Process (Connepp) which provided the basis for environmental framework legislation in the 1990s [Peek 2014]. The logic was simple: without emission standards there would be no way of controlling what went into the ambient air quality.



It took a long time for government to accept emission standards, as industry lobbied to keep them off the agenda, and another seven years to promulgate, in 2009, a compromise set of standards, positioned between the divergent views of civil society and industry. Ambient PM_{2.5} standards were not included in the initial set of standards, and only promulgated in 2012 “...because PM_{2.5} had not been recognised as a ‘criteria pollutant’ during the APPA period, i. e. PM_{2.5} was a new area of concern when the Air Quality Act came into being.”⁴²

The PM standards follow the WHO (2005) guidance of progressive implementation, meaning that they become progressively more stringent, with full compliance by 2020. However, this does not mean that the South African standards are up to WHO guidelines – they are not – or that they can adequately protect health. The main instrument of control is through the AELs, which have to comply with national emission standards, but can be tightened up by local government to achieve air quality objectives. AELs can also, in theory, be made stricter than national standards in air quality ‘priority areas’, a new tool introduced to deal with pollution hotspots created by both industrial and non-industrial sources. This is why activists expect AELs in the Highveld Priority Area to be stricter in order to bring the area into compliance.

Hotspots of the Highveld Priority Area

The HPA was declared in November 2007. The area covers three district municipalities, their local governments and one metro (Ekurhuleni). The declaration said: “The primary motivation [for the declaration] is to achieve and maintain compliance with the ambient air quality standards across the HPA, using the Constitutional principle of progressive realisation of air quality improvements.”

On this point, the declaration provides a misleading cover for continued slow implementation. Several socio-economic rights in the Constitution, like the right to housing, are qualified in so far as the state does not have the capacity to deliver on them, and must be implemented ‘progressively’ as such capacity is developed. But the environment right in Section 24 of the Constitution is not

⁴² Peter Lukey, interview 5 June 2017.



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so qualified and not subject to ‘progressive realisation’. Hence, people’s right “to an environment not harmful to their health or well-being” does not admit prevarication. The state has an immediate obligation to respect, promote, protect and fulfil the right. Second, the old APPA principle of ‘best practicable means’ did invoke the idea of ‘continuous improvement’, an inheritance of the British approach. Continuous improvement, however, is at best a tactical approach and at worst a continuation of the lax APPA regime. The AQA, by contrast, must be interpreted in terms of the environment right.

When an Air Quality Management Plan (AQMP) for the HPA was published in 2011, it specified that “ambient air quality standards for SO₂, PM₁₀ and O₃ concentrations were exceeded in nine extensive areas” [DEA 2011: 5].⁴³ The legacy of the indulgent APPA regime was to allow the creation of pollution hotspots by Eskom, Sasol, Anglo-American and other coal burning corporations on the Highveld. The descriptions of the hotspots that follow below are drawn from the HPA AQMP, which relies on modelling of ambient concentrations based on data from 2004 to 2006. ‘Predictions’ in this section refer to concentrations of pollutants produced by the model based on current information, not to predictions of the future. In most locations, actual monitoring confirms these exceedances and so corroborates the model.

eMalahleni Hotspot

For eMalahleni, the DEA model predicted “a significant number of modelled exceedances of the 1-hour SO₂ and NO₂ standards and of the 24-hour PM₁₀ and SO₂ standards.” Ambient monitoring at Phola and Witbank confirmed these exceedances. The model predicted extensive PM₁₀ non-compliance “across the northern half of the eMalahleni local municipality and into neighbouring Steve Tshwete local municipality”. It also showed ozone non-compliance. [DEA 2011: 58].

Comparisons between wind direction and concentrations of SO₂ and PM₁₀ from the DEA monitoring station in KwaGuqa township “show major contributions from the north westerly direction, with secondary sources in the south easterly

43 Exceedances against standards promulgated in 2009.



and south westerly sections. This is consistent with the large industrial area, Ferrobank, in the north west, and mining operations to the south” [59].

The report adds, “The input of industries in the area dominates the source distribution (93% of NO_x , 97% of SO_2 and 97% of PM_{10}), showing clearly that residential fuel burning, motor vehicles and coal mining are less significant in considering the total air quality loading for all pollutants” [60]. The report also observes that there is a generally high PM_{10} loading on the HPA.

Kriel

The Kriel hotspot is centred on the town of Kriel next to the twin Eskom power stations, Kriel and Matla. It again shows the massive influence of industry, as the power station emissions contribute 98% of NO_x , 99% of SO_2 and 96% of PM_{10} in the air. The model shows exceedances of the 1-hour SO_2 and NO_x standards, as well as the 24-hour SO_2 standard – creating a clear hotspot around these power stations [48]. This is also where the Elandsfontein Eskom monitoring site shows the highest acid deposition in the Highveld (see section on ‘acid rain’ earlier in this chapter).

Steve Tshwete

The Steve Tshwete hotspot, with three non-compliant nodes, extends from the border with eMalahleni in the west to Arnot in the east. It includes three power stations: Komati, Hendrina and Arnot.

At the first node, Middelburg, the DEA model ‘predicted’ that 24 hour SO_2 and PM_{10} standards are frequently exceeded. The PM_{10} exceedances were confirmed by contemporary ambient monitoring. The second, the Komati-Hendrina node, showed modelled exceedance of SO_2 , confirmed by monitoring which also showed exceedance of the ambient PM_{10} standard. There were fewer exceedances of the SO_2 standard in the east around Arnot.

Industry contribution to ambient air pollution remained high at 94% of NO_x , 97% of SO_2 and 91% of PM_{10} . Again, there are high readings for ozone,



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confirming that the pollutant shows a high concentration over the whole region.

Ermelo

The HPA AQMP reported that the Ermelo hotspot “is relatively small and is characterised by modelled exceedances of the 1-hour and 24-hour ambient SO₂ AQ standards”. Again, the area has high ozone concentrations as a result of distance and time lapse allowing emissions from the source region, mainly Secunda, to form ozone. Industry contributions to NO_x, SO₂ and PM₁₀ are above 98%.

Secunda

Two large SO₂ concentration areas, and a smaller PM₁₀ area, make up the Secunda hotspot, which “is characterised by a number of modelled exceedances of the 1-hour and 24-hour ambient standard for SO₂. Exceedances of the SO₂ standards are also recorded at the four monitoring stations in Secunda... but the frequency of exceedance is within the tolerance level” [66].

“The major SO₂ emissions are from [Sasol’s] tall stacks resulting in relatively good dispersion above the surface layer”, argues the HPA AQMP [48]. These stacks are 250 m and 301 m. However, there are also fugitive emissions, particularly of VOCs, as well as a number of chimneys which are much lower, so it is not surprising that the report also remarks that “... a number of exceedances of the SO₂ standards are predicted in the Secunda area, resulting from emissions from the petrochemical sector only [i. e. Sasol]. It is likely that these occur during looping and fumigation when the plume is brought down to ground level.” This presumably refers to the plumes from the two high stacks, as the other stacks are much lower. “As may be expected, ambient SO₂ concentrations resulting from emissions are highest at the source and decrease moving further away” [48]. This contradicts claims that the pollution is removed by winds before impacting on the immediate environment (see also box 3 above for explanations of ‘looping’ and ‘fumigation’).



Lekwa

The Lekwa hotspot derives from residential burning and industry in Standerton, and emissions from power generation at Tutuka.

Delmas

The Delmas hotspot borders on eMalahleni, and shows exceedances of the 24-hr SO_2 standard. While residential fuel burning makes a contribution to PM_{10} emissions (7%), the vast majority of pollutants are from industry: 96% of NO_x , 98% of SO_2 and 93% of PM_{10} .

Amersfoort

Amersfoort station records show elevated levels of ozone (O_3), the result of the emission of O_3 precursors from Sasol Secunda (SO_2 , NO_x and VOCs), blown down by the predominant winds from the north west. It illustrates how secondary pollutants form over this distance as the Bosjesspruit monitoring station in Secunda shows lower levels of ozone. “Hourly average O_3 concentrations show exceedances of the ... threshold ... aimed at crop protection, for a large portion of the day at Amersfoort” [47]. The AQMP argues that this is consistent with regional pollution characterised by raised levels of O_3 .

In the HPA as a whole, industrial sources are by far the largest contributor to emissions – 89% of PM_{10} , 90% of NO_x and 99% of SO_2 . The AQMP claimed that the emission inventory for industrial sources was “relatively complete” and included all industries with scheduled processes (this inventory was inherited from APPA). The baseline assessment of capacity did not paint an encouraging picture. The report pointed to “capacity challenges” in terms of available human resources, monitoring, emissions inventories and the ability to prepare AELs [10]. But the promise was that these problems would be overcome.



AQMP fails to reach its goals

The AQMP declared seven goals [111 ff]. We focus on four of them⁴⁴ using information both from the DEA's own draft mid-term review and the recent review by the Centre for Environmental Rights (CER) in collaboration with groundWork and the Highveld Environmental Justice Network (HEJN), titled *Broken Promises* [CER 2017].

Goal 1 of the AQMP was that “by 2015, organisation capacity in government is optimised to efficiently and effectively maintain, monitor and enforce compliance with ambient air quality (AQM) standards”. Achieving this was seen as consisting of mostly short term goals to be achieved within the first two years, such as ensuring that: the business plans of the DEA, provinces and municipalities are informed by the AQMP and its goals, including local governments' Integrated Development Plans (IDPs); ensuring that AQM personnel at different levels of government support each other, that all air quality officers are adequately trained, that adequate budgets are available; and the ‘optimisation’ of AQM tools like inventories, monitoring and dispersion modelling. It also included monitoring progress on the implementation of the HPA AQMP.

According to *Broken Promises*:

Neither NDM [Nkangala District Municipality] nor the local municipalities within the NDM have enough money or dedicated, appropriately-trained and skilled staff to implement the HPA AQMP and to enforce the Air Quality Act. Municipalities only have a few of the right people to do air quality management work. These officials have too many responsibilities, and are over-stretched to the extent that they are unable to devote adequate time to AQM compliance and/or enforcement. NDM has only three officials designated to do compliance monitoring and enforcement, and these municipal officials have undertaken few compliance inspections of polluting facilities. Although

44 The other three are: By 2020, all vehicles comply with the requirements of the National Vehicle Emissions strategy; by 2020, biomass burning and agricultural emissions will be 30% less than current; and by 2020, emissions from waste management are 40% less than current.



some compliance inspections and enforcement action against non-compliant facilities in the HPA have been reported by DEA, it is unclear whether this has resulted in the reduction of any polluting emissions.

In addition, the support provided by DEA for local authorities is inadequate. Moreover, the scope for local authorities' to reduce air pollution in the HPA was fatally compromised by the National Air Quality Officer's controversial decision in early 2015 to grant postponements from compliance with the minimum emission standards under the AQA to the biggest polluters in the HPA – Eskom and Sasol. This has taken away the option for local authorities to impose emission limits in AELs that are stricter than the minimum emission standards.

Goal 2 states that, by 2020, industrial emissions would be “equitably reduced⁴⁵ to achieve compliance with ambient air quality standards and dust fall-out measures”. To achieve this, the AQMP said that: emissions would be quantified from all sources; gaseous and particulate emissions would be reduced; fugitive emissions minimised; emissions from dust-generating activities reduced; greenhouse gas emissions reduced; and incidences of spontaneous combustion reduced. Industry would also contribute to achieving this goal: abatement technology would be appropriate and operational; industrial AQM decision making would be robust and well-informed, with necessary information available; clean technologies and processes would be implemented; adequate resources would be available for AQM in industry; and a line of communication would exist between industry and communities.

The DEA's own draft mid-term report says that

...measured ambient data does not indicate any significant improvement in ambient air quality since the gazetting of the AQMP. These data also indicate significant exceedances of the National Air Quality Ambient Standards (NAAQS).... It is clear from these and other measured results for air pollutants that ambient air quality is still a concern in the HPA [2017: v].

45 It is not clear what type of 'equity' this refers to.



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According to *Broken Promises*:

Air quality in the HPA has not improved in the past 10 years, despite the declaration of the HPA and the development of the AQMP. It is likely that the continued non-compliance with ambient air quality standards is, in large part, due to the failure of key major industrial facilities to reduce their emissions either adequately, or at all.

In the crucial area of particulate emissions, this review found that:

Negligible measures have been taken for the past 10 years to reduce dust emissions, particularly from mining activities – one of the major contributors to poor air quality in the HPA. This includes passing of by-laws, and undertaking some compliance inspections when there are complaints about dust. The existing National Dust Control Regulations (2013) have proved inadequate. The Department of Mineral Resources, which is responsible for regulating the environmental impacts of mines, including air quality, is absent from the HPA process.

The sub-goal of quantifying all emissions has also not been reached. According to *Broken Promises*:

Without adequately-functioning, accredited monitoring stations, we do not know whether the air quality is actually far worse than it appears. The HPA ambient air quality monitoring network has deteriorated since its declaration – the HPA AQMP listed 23 monitoring sites with available data; the DEA's draft review of the AQMP listed just nine monitoring stations with available data. Only five of the nine stations publish timeous monthly reports, available on the South African Air Quality Information System (SAAQIS) website.

It is difficult to assess directly whether key industries have reduced emissions, given that neither government nor industries make key data and documents publicly available for review. Some of the



information is available in industries' annual emission reports and/or from the National Atmospheric Emissions Inventory System (NAEIS) and SAAQIS, but this information is not complete or updated, nor is it very easily accessible to the public. The accuracy of the available information is unknown. Such information as is available has to be evaluated and interpreted by air quality experts, which is often not practical or affordable for affected people.

Goal 3 was that, by 2020, air quality in all 'dense low income settlements' would be in full compliance with ambient air quality standards. This would be achieved through implementing a strategy for dense low income settlements that would include: enabling the use of clean fuels and technology that are affordable and easily available; improved service delivery to low income areas; ensuring that adequate scientific, health and economic information is available on domestic fuel burning and air quality; ensuring that low income informal households are energy efficient; encouraging social upliftment programmes and development with air quality benefits.

Broken Promises found that:

Limited steps have been taken to reduce air pollution in dense, low-income settlements. The draft Strategy to address Air Pollution in Dense Low-income Settlements that was eventually published for public comment in July 2016, does not contain adequate, measurable and progressive plans to address the complex challenges of indoor air pollution. The draft Strategy also fails to make adequate provision for the participation of community-based and non-governmental organisations in its design, implementation, review and updating. There has been no indication of when a final Strategy will be adopted and implemented.

The AQMP's goal 5 concerned awareness and knowledge. It stated, "By 2020, a measurable increase in awareness and knowledge of air quality exists." This would include: that air quality information would be easily accessible to all stakeholders through the simplification of technical reporting and



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management plans and the development of educational material on air quality impacts in relevant official languages; the dissemination of information, for example in community libraries in the HPA and media platforms such as radio, to share information on air pollution; educational campaigns across the HPA; establishing stakeholder forums and providing training and awareness-raising courses for community leaders and councillors.

Another objective was that “research is considerate of stakeholders in the area of study”, which meant that communities, local leaders and community organisations would be consulted as part of research processes, and that indigenous knowledge would be incorporated into air quality studies. Opportunities for public participation and involvement in air quality decision-making would be readily available; community communication platforms would be established; and communities would be able to access AQM officials in emergencies.

Judging by the response of community participants in meetings of the HPA Multi-stakeholder Reference Group (MSRG), little has been done to achieve these goals outside of the actual meetings themselves. Participants insisted, for example, that air quality monitoring reports and polluters’ air quality management plans should be made available two weeks before these meetings in order to engage and prepare responses. In fact, communities see these reports for the first time in the meetings themselves, which makes engagement impossible.

The CER/groundwork/HEJN review concludes that

The HPA has, to date, dismally failed in its purpose: to improve air quality so that it at least meets the national ambient air quality standards. This means that people of the HPA are having their Constitutional rights to an environment not harmful to health and wellbeing violated. The significant air pollution means that HPA residents are dying prematurely and suffering from respiratory and cardiac illnesses that inhibit their prosperity and wellbeing. People living in the HPA, and organisations that have been active and vocal participants in the



HPA structures, are angry and frustrated by government's failure to protect health by reducing air pollution in priority areas. Pollution is not being adequately monitored or reduced, and polluters are not held accountable.

The MEC fights back

Since 2011, it appears that industry, abetted by government, has rolled back many of the gains that civil society has fought for since the 1990s.

The Durban MPP, although flawed, represented the outcome of a ten-year process of mobilisation, confrontation, engagement and negotiation between activists, officials and industry. In 2011, the monitoring system supporting the plan was dismantled by the city's administration. At the same time, the provincial premier announced plans for the expansion of the petrochemical industry [Euripidou 2014; Peek 2014]. That this could happen so easily, and in a metro area where the resources for air quality management had been built up, did not serve to build confidence in the commitment of government. It also reignited concerns about the devolution of air quality control to local government level, not least because Durban was supposed to be the pilot for devolution. Moreover, the DEA appeared not to notice the dismantling of the system until two years later.

Exempt from the new standards

In 2013 and 2014, activists from around the country were outraged to see Eskom, Sasol and other major polluters apply for exemptions from complying with 'existing plant' minimum emission standards by April 2015, and with the stricter 'new plant' standards by April 2020.⁴⁶ When it was pointed out that exemptions could not be granted under the law, they applied for postponements, which are allowed. Sasol then also applied to the courts to set

46 See <https://cer.org.za/news/media-release-rights-organisations-plan-to-join-sasol-and-natref-pollution-litigation> <https://cer.org.za/news/media-release-rights-organisations-plan-to-join-sasol-and-natref-pollution-litigation> <https://cer.org.za/news/media-release-rights-organisations-plan-to-join-sasol-and-natref-pollution-litigation>



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aside the minimum emission standards altogether – effectively to dismantle regulations governing big industry – but withdrew the action after the DEA granted postponements in February 2015.

Tracey Davies, an attorney at CER, pointed out that, despite being actively involved in setting the emission standards, and knowing about them since 2004 when the AQA was passed, Sasol, Natref and Eskom did nothing to enable compliance with the standards. “The final published standards were clearly a compromise falling short of what is actually achievable using best available technology. As a result, South Africa’s minimum emission standards are already more lenient than those required of big industry in other parts of the world, including other countries in which Sasol operates,” said Davies.

Samson Mokoena of the Vaal Environmental Justice Alliance (VEJA) said that Sasol’s claims to sustainable development were nothing more than greenwash designed to give false comfort to its shareholders. It may be that its shareholders take more comfort in Sasol’s headline earnings per share which were up 14% to a record R60.16 in the year ended June 2014, while its operating profit was up 7% to R41.7 billion.

Eskom applied for postponements in June 2013. It professed that it “had no choice” and argued:

... due to water resource, financial, and electricity supply capacity constraints, the negligible benefits of investing large amounts of money in emission reduction retrofits, and in some cases the short remaining power station life ... Eskom’s power stations will not be able to comply fully with the MES ... As such Eskom has no choice but to apply for postponement of the MES compliance timeframes for most of the fleet of power stations. [Eskom 2014].

In place of compliance, Eskom made its own emissions reduction plan. In terms of the Highveld power stations, it decided that its highest emitting stations would be retrofitted first, and that it would prioritise Particulate (PM) emissions. But it would not retrofit any emission controls at Arnot, Camden, Hendrina and Komati before they were decommissioned.



For the Highveld power stations, it would retrofit Fabric Filter Plant (FFP) at Grootvlei units 2-4, Duvha units 4-6 and at all Tutuka, Kriel and Matla units.

Eskom noted that this was in addition to existing PM control equipment:

- Electrostatic Precipitators (ESPs) at 3 of the 6 units at Grootvlei, at 3 of 6 units at Duvha, and at Kendal, Matla, Kriel, Tutuka and Komati. Electrostatic Precipitators (ESPs) work by charging particles electrostatically and then collecting them. SO₃ injection plants to improve the efficiency of ESPs had also been installed at those stations with ESPs.
- Fabric Filter Plants (FFPs) at 3 units at Grootvlei, 3 units at Duvha, and at Majuba, Arnot, Hendrina, Camden and the new Kusile plant. Fabric Filter Plants (FFPs) consist of woven bags that catch particles in the flue gas before they exit the stack. They are more effective than ESPs.

Eskom also decided that NO_x emissions would only be addressed at the three highest emitting stations on the Highveld: Matla, Tutuka and Majuba. At these plants it would retrofit Low NO_x Burners (LNB). Kendal and Kusile already have LNB boiler designs.

For SO₂, Eskom says that Kusile Power Station “will achieve the SO₂ new plant limit immediately once commissioned”. Kusile is the only Eskom plant to be built with flue gas desulphurisation (FGD).

It claims that for all Eskom power stations, including those beyond the Highveld, “...the proposed retrofits will reduce emissions of relative PM by 67% between now and 2027; relative NO_x by 25% between 2019 and 2025 and relative SO₂ by 30% between 2021 and 2027 (assuming that Medupi and Kusile are fully operational, as they will be once all these retrofits have been realised, and that power station decommissioning starts according to the 50-year life plan)” [2014:6].

When Eskom and Sasol were granted these postponements, which effectively become exemptions through rolling postponements, the hard won new air quality standards were nullified and the regulator backtracked to the previous APPA regime of negotiated non-compliance. But that is not the only loophole.



Escaping through offsets

In June 2015, shortly after granting the postponements, the DEA published draft air quality offset guidelines.⁴⁷ It was criticised at length by civil society activists. It did not come out of a 'normal' policy process but carried all the scars of a response by a weak regulator to two main polluters who were winning the argument by simply refusing to comply. At the same time, the DEA also published a more extensive defence of offsets.⁴⁸ It covered five areas of application: air quality, wetlands, biodiversity, water resources and carbon offsets. Both documents claimed that offsets would balance protection of people's health and environments with the need for economic development.

It was immediately evident that air pollution offsets would target smoke from domestic fires. Environmental justice activists support measures to eliminate energy poverty and so relieve people's dependence on dirty fuels such as coal and paraffin. Eliminating indoor pollution is particularly urgent. But they ask: why is it necessary to allow massive regional pollution and undermine hard won air quality legislation in exchange for the polluters taking over governments' work? The big corporations have no competence in community development and, thus far, it appears that they will choose low cost options of questionable effectiveness.

In a workshop following the release of the 2015 policy, communities and activists generally agreed that the air offsets would not work. Those proposed by Eskom and Sasol were viewed as a way of shifting blame onto communities. There is no comparison in the scale of emissions from industrial and domestic sources and it was argued that interventions to reduce domestic emissions are a responsibility of government and should not depend on offsets.

It is particularly galling that government had failed to address domestic emissions in any meaningful way but, over the last decade, has tried to do it on the cheap with the *Basa Njengo Magogo* programme. This involves teaching people to put the kindling on top of the coal, instead of at the bottom, when lighting a fire. Government and corporations claim that this reduces particulate

47 Government Gazette, June 2015

48 Department of Environment, Discussion Document on Environmental Offsets, June 2015



emissions but it does not come close to eliminating them and does not reduce sulphur or volatile organic compounds at all. It is a wholly inadequate as a response to pollution caused by energy poverty (Euripidou, 2014).

Current South African air quality offsets are based on the assertion that domestic emissions have greater health impacts than industrial emissions because they are emitted at ground level where people live. Air quality activists have never accepted this argument as based in science because:

- household emissions are dwarfed by industrial emissions;
- recirculation and deposition of regional industrial pollution is not taken into account;
- 50% of PM₁₀ pollution comes from coal mine dust entrainment (most of it through haulage/transport);
- persistent ground level pollution (with high percentages of VOCs) from spontaneous combustion from coal have not been quantified or included in calculations; and
- few detailed studies on household indoor pollution have been done, and their results are inconclusive.

Nevertheless, in March 2015, the Department of Environmental Affairs (DEA) allowed Sasol to 'postpone' compliance with minimum emission standards in exchange for offsets. The offset programme consists of a mixed bag: measures to deal with veld fires; testing emissions of heavy vehicles entering Sasol premises, reducing dust from unsurfaced roads – which activists suspected was meant to create a new market for a Sasol chemical product that would be cheaper – and nastier – than tar roads; intervention in municipal recycling and household waste collection; as well as cheap retrofits to houses including potentially flammable polystyrene insulation.

groundWork responded that “this is the cheap option to compliance. It works in the same way as a mediaeval indulgence: Sasol may carry on sinning, at



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considerable profit, providing it pays the much lesser cost of a penance”.⁴⁹ It continued:

The minimum emission standards enable communities to hold corporations liable for polluting them. The offset absolves the corporation of liability. At the same time, it outsources government’s responsibility for healthy human settlements served with clean energy. Thus, the interests of the community are at stake on both sides of this deal. Yet this deal is struck between Sasol and government. In so far as communities have been consulted, they have denounced offsets in principle and this deal in particular. It appears, however, that the matter was already decided and community views were already excluded.

In discussing these proposals, including at meetings called by Sasol, people from community organisations reiterated several points:

1. These projects cannot substitute for compliance with minimum emission standards. Sasol must provide a roadmap to compliance showing what steps Sasol will take by what dates. Sasol’s response, that it cannot guarantee compliance by the end of the postponement period and may therefore request further postponement, suggests postponement without end and is not accepted.
2. Implementation of priority area air quality management plans (AQMPs) is the primary process and government and corporations must demonstrate their commitment to reducing industrial emissions within set timeframes in that context. The so called offset projects must not divert that process, nor be given priority within it.
3. Source apportionment studies have been mandated within the AQMP process and should be funded by Sasol and other corporations on the polluter pays principle. Sasol should not be in a position to control the offset source apportionment study, or to divert resources from the main study.

⁴⁹ groundWork response to Sasol offset implementation plan, 29 January 2016.



4. A baseline for the distribution of pollution is necessary but not adequate. There must also be a baseline for people's health so that the existing health impacts of pollution are understood before Sasol's offset projects are implemented. Such a study should create the basis for monitoring people's health through the systematic collection of statistics from hospitals, clinics and doctors. Baseline studies and health monitoring should be under the auspices of the AQMP as any process managed by Sasol or other corporate polluters will lack credibility.
5. Since Sasol's projects are accounted as offsets, are they terminated with the expiry of the postponement or when Sasol's plants are brought into compliance with minimum emission standards? Who then takes responsibility for the projects?
6. Irrespective of what Sasol does with its offset projects, government must pick up its responsibilities concerning domestic energy and emissions. To date, government has done nothing more than the *Basa Magogo* programme which was always a cheap way of avoiding a real response and has proved utterly ineffective.
7. Similarly, government needs to provide healthcare staff and facilities adequate to the crisis of health created by the pollution of the Vaal and Highveld. This should include 24-hour clinics able to respond to emergency pollution events at night and specialist staff to deal with respiratory illness. The system must be developed to enable better access to public healthcare.

On this last point, we note that local people do not trust that corporate health professionals will give a proper diagnosis where the corporation's activities are the likely cause of illness.



Box 7: Offsets are a policy threat

Offsets benefit industry in many ways, and are a threat to building a reasonable regulatory regime. They undermine democracy. In summary, here is a list of the main concerns of South African activists about air quality offsets:

- The use of offsets inverts the mitigation hierarchy.⁵⁰ Offsets will always be preferred to mitigation measures (including the “no development option”) if they are cheaper (like Eskom and Sasol’s air quality offset proposals). Hence, there will be pressure to cut costs of the offset.
- Offsets are used to justify the unjustifiable: projects that should be rejected are permitted on the basis of offset proposals; illegal practices (such as exceedance of minimum emission standards) are permitted on the basis of offsets.
- Regulatory capacity is inadequate to the task and provides no oversight. The assumption that offsetting compensates for weak regulatory and planning capacity is false. To the contrary, it exacerbates it.
- Offsets will tempt government to abandon responsibilities rather than build capacity to meet them – thus playing into the arms of the business lobby (next item).
- Offsets will call forth a business lobby for weak regulation of a new market in offset buying and selling on the argument that the market will be more ‘efficient’ than regulation – that is efficient in money terms, not biodiversity terms, but proponents will elide the difference. In the UK, business proponents are lobbying against government establishing a central registry of offsets, which will prevent any national overview and inhibit evaluation.
- While destruction from the original project is certain, benefits of the offset are not – indeed, some offsets may themselves be destructive.

50 Even if we agreed with offsets, which we do not, it would be the last step in the ‘mitigation hierarchy’, which consists of the following steps: avoid or prevent damage, minimise, rehabilitate, offset.



- Offsets usher in the commodification and financialisation of nature.
- If there is real money involved (as proponents hope) big capital will move in. Offset providers will not be restricted to small and ethical biodiversity practitioners. It will be profit driven.
- Offsets will not be maintained if profits or securities (bought and sold globally) decline, offset providers are bankrupted or property values favour different land-use. In the UK, business proponents are already arguing for time-limited offsets to avoid 'sterilising' land – meaning removing it from the market. In this context, it is striking that what is economically sterile is ecologically fecund and vice versa.
- The use of offsets will depend on a series of false equivalences – between what is destroyed and what is preserved and between ecological and money values. (How many chameleons are worth a hawk and what's the price?)
- Offsetting will mask the fact that habitat and species loss is irreplaceable. 'No net loss' is merely an advertising slogan.
- Calculation of offsets and equivalences will depend on reductive simplifications of complex ecological systems.
- This will start with delimiting the supposed area of impact: for example, focusing on a wetland and its immediate surrounds and excluding cumulative impacts on the catchment. (Note: this is already common practice in EIAs so it is very likely to be transferred to offsets.)
- People may be removed for the original project (to make way, for example, for mines) and then again for the offset itself. This may be because people lose jobs with the change of land-use (already observed on the change from farms to game farms and the eviction of farmworkers) or because people who used land and natural resources in the offset area are excluded from doing so (as is likely in former Bantustan areas).



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- People will lose access to natural areas and resources turned over to development and offset at distant locations.
- Within specific catchments or airsheds, the offsets may be overwhelmed by the accumulation of destructive activities – like acid mine drainage ruins wetlands preserved as offsets to the mining projects; air quality offsets fall far short of the scale and geographic spread of industrial pollution (for example, the Eskom and Sasol proposed offsets).

A failure to establish ‘adequate control’

After more than a decade of community struggles to improve air quality in polluted areas and polluted communities, a reluctant government regulator was finally moved to create both ambient and emission standards which were intended to become progressively stricter to achieve a reduction of air pollution. But, as the new standards tightened up on pollution, the two biggest polluters on the Highveld, Eskom and Sasol, applied for “postponements” from the regulator to comply with these standards – postponements that may be rolled over and so could effectively become exemptions.

And after two regimes of air quality management – APPA and AQA – the same problems persist: industry makes decisions about its own pollution control; health impacts are still not properly researched or taken into account; ecosystem impacts, such as those of acid rain, are only beginning to be recognised but do not seem to make an impact on regulation; there is an enduring lack of capacity within government, and air quality continues to deteriorate. It seems clear that government has not established ‘adequate control’ over air pollution on the Highveld while the big polluters have obstructed it.



3

Corporate Highveld

This chapter turns to the actors who have contributed most to the pollution of the Highveld atmosphere by burning coal: Eskom's twelve power stations, Sasol's petrochemical complex at Secunda and the metallurgical plants in eMalahleni and Middelburg.

Eskom burns masses of low grade coal to provide the once cheap but still dirty power that drives the minerals-energy complex. This chapter traces its stubborn defence of the continued use of coal regardless of the climate crisis. Eskom seeks to perpetuate a history of autonomy from outside influence, and to retain the right to make its own decisions about pollution control. In the process, it makes decisions for millions of South Africans, including resisting and delaying the expansion of renewable energy, even as it sinks into its own deepening crisis of corruption as a poster boy for state capture.

Sasol, its assets and expertise built through lavish subsidies under apartheid, continues to expand on the basis of 'monetising hydrocarbons' into Mozambique and the United States, where it has gained another set of lavish subsidies. In addition to being a large polluter, the Secunda plant is the biggest point source of greenhouse gases on the planet.

The section on metals traces the history of a complex of plants in Witbank and Middelburg producing iron, steel, vanadium and ferroalloys, once dominated by Anglo American but now being passed from one investor to another. Finally, this chapter considers the manoeuvres of the coal and nuclear lobbies on the planning battlegrounds around the Integrated Resource Plan (IRP) for electricity production.



Eskom

Eskom is central to the minerals-energy complex (MEC) which shaped South Africa's development. The MEC created a highly concentrated economy – with wealth in the hands of a very few large corporations – marked by racism, extreme inequality and dirty production. Eskom's history is sketched in Part 1 of this report. To recap briefly, it was established by the Electricity Act of 1922 as a state owned corporation. It was to run on 'business principles', but neither at a profit nor a loss, to provide 'cheap and abundant power' to industry. The gold mines were the largest consumers of power but this market was already controlled by the privately owned Victoria Falls Power Company (VFP) in which the Randlords had a stake. Eskom had one ace: the Electricity Act enabled it to veto VFP plans to build a power station at Witbank to supply the Rand gold mines. Finally the two utilities struck a deal: Eskom would finance and own the station but the VFP would build and operate it. VFP also took the profits. The Witbank Power Station was completed in 1926.⁵¹

Following the Second World War, Eskom was able to show the mining houses that VFP had made war time profits at their expense. Led by Anglo American, they then supported Eskom's bid to expropriate VFP and establish a state owned monopoly. Anglo even sold its own Kimberly Power Station to Eskom. In return, Eskom lowered the price of electricity to the mines while building more power stations – funded by World Bank loans – to cater for a rapid expansion of demand from the gold mines which then consumed nearly 60% of Eskom's supply.

Through the 1950s, Eskom was always playing catch-up as demand ran ahead of supply. This had two major effects according to energy analyst Andrew Marquard: first, it "produced an organisational culture based on continuous expansion"; and second, managing the power shortages "necessitated close cooperation with the gold industry" who could "predict and if necessary shed load" but "could not afford unplanned loss of load" for safety reasons [2006: 152]. The mines and other energy intensive users then became intimate insiders in Eskom's planning system. These other big users included Iscor

51 This section is modified from Hallows 2011, Chapters 7 and 8.



and Sasol. Iscor was established as a state owned iron and steel corporation alongside Eskom in the 1920s. It built its massive plant at Vanderbijlpark after the war. Sasol, also state owned, was established in 1950 and started producing from the Sasolburg plant in 1956.

In the 1960s, the big metal plants on the Highveld went up. Anglo's Highveld Steel and Vanadium in Witbank was completed in 1968 while Rand Mine & Bulloch established Columbus and Ferrochrome as twinned plants in Middelburg. This was followed in the 1970s and 80s by more ferroalloy smelters on the Highveld at Machadodorp and Lydenburg and in the Steelpoort valley. The biggest mega-project of the late 1970s was Sasol Two at Secunda. It was almost immediately doubled in size as the apartheid state, fearful of sanctions on crude oil imports, demanded the addition of Sasol Three.

Centralising Power

The electricity supply was initially divided into various 'undertakings', the first being VFP's 'Rand Undertaking'. From 1960, Eskom's various undertakings were increasingly joined up to create the single national grid. The big power plants were then clustered atop the Highveld coal fields while small local plants in towns across the country were closed down and Eskom blocked plans for new municipal plants. This enabled Eskom to rationalise power generation and centralise administration, planning and information systems and direct policy. Its own inclination for secrecy was reinforced and protected by security legislation and its monopoly on strategic information allowed it to head off challenges to its 'autonomy' – that is, to its capacity to dictate policy – from within the state elite.

The centralised institutional and technological regime enabled changes to the labour regime. Both black and white workers had periodically demonstrated their power to disrupt production in the first half of the twentieth century and had been brutally suppressed by force of arms. Eskom had long aimed to minimise and isolate its labour force. Its new power stations were always capital-intensive and, with the grid in place, they could be built in remote areas while still subject to centralised management. White workers were bought



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off with apartheid privileges and collaborated in the despotic management of the workplace. Black migrant workers on contract were made to feel their vulnerability to dismissal and were housed in tightly controlled compounds distant from the urban centres of working-class agitation.

The resistance, however, was felt in a different dimension. Eskom's expansion was funded through massive borrowing on local and international markets and, by the mid-1970s, this was weighing heavily on the national economy. The Soweto uprising in 1976 deterred foreign lending and Eskom then started pushing up the electricity price to boost its own capital fund to pay for further expansion. It nevertheless cushioned big industry with a subsidy to energy intensive users [Marquard 2006: 163]. Access to new foreign loans was finally cut off altogether in 1985, the year in which government declared a moratorium on debt repayments.

Before 1976, Eskom borrowed cheaply from the flood of 'petrodollars' produced by the 'oil shock' price rises. In the 1980s, it was caught in the debt trap created when the US pushed up interest rates while the value of the Rand dived. Between 1983 and 1986, Eskom's interest payments rose from 28% to 45% of its total costs.⁵² The price of gold and commodities collapsed from record highs, the economy went into recession, anti-apartheid sanctions began to bite, and Eskom's projection of future demand proved wildly wrong. By the end of the decade, generating capacity exceeded peak demand by 62% [Eberhard & Van Horen 1995: 49].

Eskom was then forced to mothball some plant while desperately trying to boost demand. It offered the world's cheapest electricity to energy intensive big industry. The cheapest power of all went to BHP Billiton's new Hillside and Mozal aluminium smelters in Richards Bay and Maputo. Eskom switched on Majuba, its newest power station, four years after it was completed, just as Hillside went into production in 1996.

It also initiated an electrification programme in 1991, both to use up some of its excess generating capacity and to reposition itself politically. For the anti-apartheid movement, the discriminatory distribution of services was a key

⁵² Eskom Annual Report 1986: 54.



issue. The well-lit high-consumption suburbs of white South Africa contrasted starkly with the dark and grimy black townships where “more than 80% of households did not have access to electricity” [Greenberg 2009: 28]. Providing access to energy, and specifically to electricity, became a political imperative during the transition period. The ANC’s Reconstruction and Development Programme (RDP) set a target for connecting 2.5 million homes between 1994 and 1999 and this was one of the few RDP targets that was met and exceeded. For Eskom, electrification brought political dividends but the anticipated economic returns did not materialise. People got ‘access to electricity’ but most did not have the means to pay for it. Hence, the newly electrified households consumed less than expected and did not generate the scale of returns to cover infrastructure costs. And people did not get the health benefits of clean energy indoors but continued to use coal, wood and paraffin for heating and cooking.

Policy contradictions in transition

In the 1980s, the apartheid government initiated the neo-liberal policies that would mature over the period of the political transition. The privatisation of Eskom was mooted, although not implemented, and the founding requirement that it operate without profit was revoked, marking a significant turn towards commodifying public services [Gentle 2009]. Eskom again raised tariffs, provoking industry and the mines to call for tighter government control to force it to operate on ‘business principles’. If this sounded contradictory, Eskom then raised the alarm about ‘politicians in the engine room’ even as it dictated policy to its supposed masters in the Department of Minerals and Energy (DME). Its corporate sense that it was a law unto itself was even more sharply revealed as the political transition got underway. According to its then boss, Ian McRae, staff feared that a new ANC government would ‘nationalise’ the corporation [McRae 2006: 78].

In fact, following the logic of the misnamed Growth, Employment and Redistribution (Gear)⁵³ economic policy of 1996, the ANC government’s 1998

53 Gear produced little growth, substantial job losses and increased inequality – redistribution from poor to rich.



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White Paper on Energy proposed privatisation on the assumption that ‘the market’ would lead the action to create economic growth and jobs. It predicted that new power plants would be needed by 2007 and said that building them should be left to the private investors. Eskom then found itself defending against proposals to break up its generating monopoly into supposedly competitive bundles to be sold off to the private sector and to hand the grid over to a separate state entity. Its arguments were supported by the real heart of the energy policy: the long-term commitment to cheap energy for industry as the foundation of international competitiveness. While government barred Eskom from planning new plants, private investors were not interested so long as there was no price escalation in prospect.

The privatisation policy was suspended in 2004 as government adopted the rhetoric of the developmental state. Amid alarms that economic growth was now overtaking the capacity to deliver power, Alec Erwin, then Minister of Public Enterprises, announced that “R107 billion will be needed between 2005 and 2009 to meet the country’s growing energy needs. Eskom will invest R84 billion over the next five years. The balance of R23 billion is reserved for independent power producers (IPP) entrants”.⁵⁴ New coal-fired generators were supposed to be up and running in 2008. The instruction to Eskom was too late already. As Trollip et al [2014] point out, it takes at least nine years to build the big ‘six pack’ power plants favoured by Eskom and, to meet the deadline, the decision to build should have been made by 2000. Private IPPs, meanwhile, did not appear even to make a proposal as the electricity price was still too low to yield a profit.

Eskom and government nevertheless continued to pump up demand, even as the surplus capacity (or “spinning margin”) was consumed. As global commodity markets boomed, they offered cheap power to investors in energy intensive industries and Eskom was instructed to plan for government’s GDP growth target of 6%, set by the Accelerated and Shared Growth Initiative for South Africa (ASGISA), instead of actual growth projections of around 4%.

⁵⁴ Minister Alec Erwin, ‘Economic Cluster: Higher Growth, Sustained Growth, and Shared Growth’, Parliamentary media briefing, 17 February 2005.



In 2005, major expansions were either planned or in progress in the Mpumalanga platinum mines, at the Hillside and Mozal aluminium smelters, at Columbus Steel and ArcelorMittal, and at Sasol. New ferrochrome plants were under construction by Xtrata at Steelpoort, International Ferro Metals (IFM) at Brits and Tata at Richards Bay while Samancor and ASA Metals⁵⁵ expanded existing plants. Most spectacularly, government signed a deal with Rio Tinto Alcan to invest in an aluminium smelter at the empty Coega Industrial Development Zone (IDZ) near Port Elizabeth. The smelter would require a 1 355 MW power supply and government baited the deal with subsidised electricity as well as a big tax break.

Breaking bad

In the middle of this gung-ho expansion, the national power supply crashed in January 2008. In September 2007, Eskom briefed government and business to expect load shedding but it “reacted as if it were caught unaware” when the lights went down, according to the National Energy Regulator of South Africa’s (Nersa) report on the crisis [2008: 9]. It made no active preparations for a major loss of power and allowed its coal stockpiles to decline throughout 2007, even as it used more coal to run plants harder to keep pace with rising demand. It seemed to have learned nothing from the 2006 dress rehearsal when a unit at the Koeberg nuclear power plant broke down and the Western Cape went dark.⁵⁶

Following the January blackouts, Cabinet declared a national emergency and promised “vigorous and coordinated action” from “team South Africa”. This was the National Electricity Response Team (NERT), composed of government, Eskom and corporate business with the unions in the corridors and the rest of civil society not invited. Team South Africa, however, barely held together. Despite the rhetoric, top-level leadership from government was not evident.

55 A partnership of Sinosteel (60%) and Limpopo Economic Development Enterprise (40%), a provincial government agency.

56 This section draws on and updates the groundWork Report 2015. Chapter 4 of that report gives a more detailed account of the turbulence at Eskom and the breaking up of the minerals-energy complex up to 2015.



Box 8: Eskom's New Build

Eskom's new build started with two Open Cycle Gas Turbine (OCGT) plants – Ankerlig and Gourikwa – designed to be turned on and off in response to peaks in demand. They are in fact powered by diesel but could be switched to gas. The return to service of the old mothballed coal plants – Camden, Grootvlei and Komati – followed with a total capacity of 3 645 MW.

Ingula is a pumped storage station, also designed to respond instantly to peak demand, with a capacity of 1 350 MW. All four units were commissioned in 2016. A second pumped storage scheme, Tubatse, was cancelled as the new build costs started to escalate. Pumped storage consists of two dams at different levels. Water is pumped to the top dam when there is surplus power and released to the lower dam when power is needed.

The 100 MW Sere wind farm is the only renewable energy project. It was built in under two years and commissioned in January 2015. A 100 MW concentrated solar power plant, announced in 2007 and ignored since, has now been cancelled.

The two giant coal-fired power stations, Medupi and Kusile, with a combined capacity of 9 600 MW, are at the centre of the new build. Over-budget and over-time, they are also at the centre of Eskom's ever deepening crisis. Each plant has six units and these are now coming on line. Medupi units 6 and 5 are fully commissioned and unit 4 is being synchronised to the grid. Kusile unit 1 is commissioned and unit 2 is being synchronised. Kusile is the first Eskom plant to be built with flue gas desulphurisation (FGD). Medupi was not built with FGD despite the high sulphur content from the Grooteegeluk colliery. Retrofitting FGD from 2021 was a condition of a World Bank loan for the plant but the necessary supply of water is not assured. Medupi is presently out of compliance with its Air Emissions Licence.



Eskom muddled through the immediate crisis by imposing a 10% supply reduction on the big energy users, who cooperated more or less grudgingly, with load shedding for the rest.

Then, as the threat of rolling blackouts receded after May 2008, government lost interest and abandoned the NERT to the corporates.⁵⁷ Officials were perhaps distracted by the political drama of President Thabo Mbeki's ousting in September and the accession of Jacob Zuma following the 2009 elections. Team Eskom was also falling apart. Bobby Godsell, a former Anglo executive brought out of retirement in 2008 to chair Eskom's Board through the crisis, resigned in November 2009 following a boardroom tussle with CEO Jacob Maroga. Maroga's victory was short lived as the Board ousted him two days later.

Industry claimed large losses from both the outages from reduced production in what were, in reality, the dying days of the commodity boom. In September 2008, Lehman Brothers, one of the big five Wall Street investment banks at the heart of global capital, went bust and global financial markets crashed. In October, the commodity boom turned to bust. Recession saved Eskom. As smelters and mines closed or went onto short time, the spinning margin was restored from 5% in January 2008 to 14% in January 2009 – one point short of Eskom's target of 15%. Rio Tinto pulled the plug on the Coega deal in 2009, citing Eskom's inability to guarantee the power supply but without mentioning that the price of aluminium had crashed alongside Wall Street. By the end of 2009 in South Africa, a million jobs had been lost across the economy.

Eskom was meanwhile demanding ever bigger increases to the electricity tariff, primarily to pay for the escalating costs of the new build as well as for rising coal costs. As the 2015 groundWork Report observed, it was buckling under the strain of trying to reproduce the MEC model of big base-load generators to produce cheap and abundant power for energy intensive mining and minerals industries. When Erwin announced the new build in 2005, the estimated cost was R87 billion and each of the big "six pack" plants was estimated at R30

⁵⁷ Terence Creamer, *Electricity Crisis Response Team Hits Turbulence*, Engineering News, 3 November 2009, and *Government at Fault for Inertia around Power-Crisis Structures, Manuel Admits*, 8 December 2009.



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billion. That used to sound like a lot of money but it has been dwarfed by the subsequent escalation shown in Table 8.

Table 8: Medupi and Kusile cost escalations

	2005	2007	2009	2010	2014	2016
Medupi	R30 bn	R79 bn	R100 bn	R125 bn	R154 bn	R195 bn
Kusile	R30 bn	R84 bn	R110 bn	R145 bn	R172 bn	R225 bn

Costs up to 2010 are from Eskom as quoted in various media and exclude flue gas desulphurisation (FGD) at Medupi; Eskom subsequently clammed up and 2014 and 2016 are estimates from Chris Yelland and include FGD at Medupi.⁵⁸

It should be emphasised that these were precisely the plants wanted by big industry. But cheap is no more – except for BHP Billiton’s (now South32) aluminium smelters which refused to give up their special pricing agreements. Electricity prices have risen five-fold since 2008. For mines and big industries, the cost of power increased from under 10% to as much as 30% of total costs.⁵⁹ It is not just the MEC that is falling apart. These investments are dragging the country into a 1980s type debt trap as groundWork [2009] warned. And they are driving poor people, particularly those who depend on electricity, towards destitution as their energy costs escalate.

From 2010, China responded to the economic crisis with a massive stimulus programme focused on infrastructure – new high speed railways, new airports, even new cities. Much of it was not needed and remains unused but it created new demand for commodities. A frenzy of speculators then joined in to create another boom. South Africa was meanwhile hosting the World Cup and building stadiums that, like the new Chinese cities, are now mostly empty. Government demanded that Eskom ‘keep the lights on’ through the 2010 football world cup, the 2011 CoP17 and the 2014 elections. It took desperate measures to do so: it put off doing maintenance to overworked generators; offered ‘buy-

58 Terence Creamer, *Eskom moves to explain why coal projects will now cost R211bn*, Engineering News, 23 January 2009; Chris Yelland, *Interview with Eskom finance director Paul O’Flaherty*, EE Publishers; 9 June 2010; Chris Yelland, *Eskom’s white elephants – Medupi and Kusile – dampen electricity price outlook*, EE Publishers, 6 July 2016.

59 Jan de Lange, *SA gold mines are on the brink of death*, City Press Business, 2 July 2017; EIUG website visited at 20 August 2015 www.eiug.org.za.



backs' to the ferroalloy corporations which shut down smelting plants and 'sold' the unused power back to Eskom at a fat profit; and overworked its 'peaking power' plants with spectacular consequences for its diesel fuel bill. It also purchased newly built renewable power from IPPs as it came available.

By 2014, Eskom was running out of options: Nersa stopped it using the buy-backs to reduce demand; it failed to get Medupi up and running before its existing and neglected plant started collapsing; its coal supply was deteriorating; floods in March 2014 turned coal dust to slurry and took out Kendal power station; and it was running short of money for diesel. Outages in March were followed by more or less routine load shedding from November through to mid-2015.

This was despite declining demand. The China commodity boom peaked in 2012 and prices crashed in 2014. In the second half of 2015, falling demand once more restored Eskom's spinning margins and the first unit at Medupi came on line. Since then, the Ingula pumped storage plant has been fully commissioned as have been the first Kusile unit and the second Medupi unit. Eskom's problems have reversed – from shortage to surplus. Hence, Eskom is once more tearing up its demand side management strategy and is also renegeing on contracts to buy power produced by the renewable IPPs.

Rotting from the head

In 2014, Eskom's top management was also falling apart and the integrity of governance collapsed. It is not that Eskom had a clean record before this. The dodgy dealing started as soon as the new build was announced, when Eskom awarded the R40 billion contract to manufacture the boilers for both Medupi and Kusile to Hitachi Africa. The ANC's Chancellor House investment company was Hitachi's accredited Black Economic Empowerment (BEE) with a 25% holding and, when the contract was awarded, Valli Moosa was Eskom chair and also serving on the ANC fundraising committee. The US Securities and Exchange Commission (SEC) alleged that Chancellor House benefitted



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by US\$12 million and, in 2015, fined Hitachi \$19 million.⁶⁰ Further, when the lights went out in 2008, it was alleged that Eskom had purposely run down its coal stocks to favour BEE mining and trucking companies with short-term supply contracts. Nersa suggested that Eskom had subordinated national energy security to its 'business objectives' – that is, promoting BEE entrants, cutting short-term costs and boosting management bonuses.⁶¹

In 2014, Brian Dames, who succeeded Maroga as CEO, and several other top executives, left Eskom. With that, it seems, the flood gates began to open. As related in Part 1 of this report, Board members then took direct control of Eskom's executive and immediately forced through contracts with the Gupta's newly founded Tegeta coal company as well as with its New Age media house. Tegeta's coal did not meet Eskom specifications but the supply contract was greatly expanded in the following year. Then followed the sale of Glencore's Optimum Coal Holdings to Tegeta, a deal forced through by newly installed Eskom chair, Ben Ngubane, new CEO Brian Molefe, new Chief Finance Officer (CFO) Anoj Singh, and new Minister of Mines, Mosebenzi Zwane. Zwane's predecessor, Ngoako Ramatlhodi, has since said that Zuma sacked him because he refused to do Ngubane and Molefe's bidding to force the sale.⁶²

In October 2016, the Public Protector published her *State of Capture* report into "alleged improper and unethical conduct by the President and other state functionaries" concerning the Guptas' involvement in "the removal and appointment of Ministers and Directors of State-Owned Enterprises" to benefit their businesses [2016: 1]. The report showed that a majority of Eskom Board members, appointed by Minister of Public Enterprises Lynne Brown, were linked to the Guptas. It also implicated Molefe in forcing the sale of Optimum

60 Stefaans Brümmer and Sam Sole, *Moosa in R38-billion tender conflict*, Mail & Guardian, 8 February 2008; United States District Court for the District of Columbia, *Securities and Exchange Commission v Hitachi*, 28 September 2015.

61 James Myburgh, 'Eskom: The Real Cause of the Crisis', *Politicsweb*, 1 February 2008; National Energy Regulator of South Africa (NERSA). 2008. *Inquiry into the National Electricity Supply Shortage and Load Shedding*. Report by the Energy Regulator. 12 May 2008.

62 See, amongst others, AmaBhungane stories by Susan Comrie, Sam Sole and Stefaans Brümmer: *How Brian Molefe 'helped' Gupta Optimum heist*, 16 May 2017; *Gupta mine grab: how Brown misled Parliament*, 18 May 2017; *#GuptaLeaks: How Eskom was captured*, 9 June 2017. At <http://amabhungane.co.za/>



and in making ‘pre-payments’ to Tegeta for coal from a mine that it did not yet own in order to give it the cash to buy that mine.

Three weeks later, Molefe announced his resignation, “in the interests of good corporate governance”. He said he would leave Eskom on the 1st of January 2017. It subsequently emerged that this date was chosen in an attempt to legitimate an illegitimate pension pay-out.

Molefe was then shoehorned into Parliament as an ANC MP. Rumours immediately circulated that he was being lined up to replace Pravin Gordhan as Minister of Finance and so to capture the National Treasury for the Zuptas, as the Economic Freedom Fighters (EFF) have branded them.⁶³ This would reverse the earlier defeat, in December 2015, when Zuma replaced Nhlanhla Nene with David van Rooyen at Treasury but was immediately forced to back down and replace Van Rooyen with Gordhan. The rumours were perhaps intended to test levels of resistance to Molefe’s appointment. In the event, Zuma sacked Gordhan and his deputy Mcebisi Jonas at midnight on the 30th of March 2017. But he appointed Malusi Gigaba, a trusted lieutenant with senior cabinet experience at Public Enterprises and Home Affairs, with Sfiso Buthelezi as deputy minister with oversight of the large pool of money at the Public Investment Corporation (PIC).

Gordhan’s sacking widened already bitter divisions within the ANC and what is left of the tripartite alliance. ANC elders and notables, the South African Communist Party (SACP) and Cosatu called on Zuma to resign. The ANC’s ‘top six’ officials were divided down the middle and, for the second time in six months, the National Executive Committee debated whether to recall him. Zuma survived.⁶⁴ Wall Street rating agencies, meanwhile, downgraded South Africa to junk status.

63 Adri Senekal de Wet, *Molefe to be Minister of Finance – sources*, Business Report, 27 March 2017;

64 Amongst very many others, see: Lizeka Tandwa, *Cosatu joins SACP in calling on ‘negligent’ Zuma to resign*, News24 BizNews.com, 4 April 2017; Matuma Letsoalo, *Teflon Don gets his way: Zuma emerges victorious again*, Mail & Guardian, 4 April 2017; Ray Hartley, *The ANC is now a wholly owned subsidiary of Jacob Zuma Enterprises*, Business Live, 5 April 2017; News24, *ANC briefs media on NEC meeting outcome*, 29 May 2017.



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Two weeks later, on the 16th of April, the Sunday Times published a leaked story that Molefe would get a R30 million pension payout for his 18 months at Eskom.⁶⁵ Brown allowed a week for public indignation before announcing, with due gravity, that she had “declined Eskom’s proposal” as she “found the argument presented by the Board on why the pension arrangement was conceived lacking in legal rationale...” She told the Board to consult Molefe and report back with “an appropriate pension proposal”.⁶⁶ Two weeks later, on Friday the 12th of May, Eskom declared it could not come to an appropriate agreement with Molefe. “The Board, therefore, rescinded Molefe’s early retirement application,” said chair Ben Ngubane. A sagacious Brown then found this a “better value proposition” than paying him out R30 million. At the same time, the Board said the acting CEO Matshela Koko would “go on leave” while Eskom contracts awarded to his stepdaughter’s company were investigated. Molefe promptly resigned from parliament and was at work at Eskom on Monday morning.⁶⁷

Molefe’s resignation was thus redefined as early retirement. When it seemed that would not hold up, the players in this low farce represented his five months absence from Eskom as ‘unpaid leave’.⁶⁸

These scenes made a theatre of the collapse of governance at Eskom and confirmed what has long been evident. It is not just that the corporation and its shareholder lack integrity but that nothing it says can be trusted. Dishonesty is soaked into the organisation.

There was widespread anger at Molefe’s reinstatement. All political parties condemned it, including the ANC which said, “We are embarrassed by the comments of the minister, her embracing of what is immoral and what is an illegal decision by the Board.” It called on her “to rescind her decision or to

65 At <http://www.timeslive.co.za/sundaytimes/stnews/2017/04/16/Brian-Molefe-scores-R30-m-payout-from-Eskom>.

66 Media Statement issued by the Department of Public Enterprises, *Minister Lynne Brown declines Brian Molefe’s pension pay-out*, 23 Apr 2017

67 See amongst many others: Siseko Njobeni, *Brian Molefe to return to head Eskom*, Business Report, 12 May 2017; Terence Creamer, *Brown defends shock Molefe reinstatement, as Koko takes leave amid forensic probe*, Engineering News, 12 May 2017; Asha Speckman and Pericles Anetos, *Eskom tempts fate with somersault on Molefe*, Business Live, 14 May 2017.

68 Phillip de Wet, *Now Eskom’s Molefe was on ‘unpaid leave’*, Mail & Guardian, 22 May 2017.



dissolve the Board”.⁶⁹ The DA and the EFF took the matter to court. Molefe lasted two weeks in the CEO’s office. On the 31st of May, Brown told the Board to remove him.⁷⁰ Shortly thereafter, Ngubane resigned from the Board and Brown then also removed Chwayita Mabude, the last of the Board members appointed by Gigaba in June 2011. The leaked Gupta e-mails show that the family nominated her for the Airports Company (Acsa) Board in 2012.⁷¹

Johnny Dladla, from the investment arm Eskom Enterprises, has now been appointed acting CEO and Zethembe Khoza is acting chair of the Board. Singh, Eskom’s CFO who followed Molefe from Transnet in 2015 and is known to be a recipient of Gupta largesse, initially remained in place. He authorised guarantees for the Gupta’s purchase of the Optimum mine as well as payments to the Gupta-linked Trillion financial advisory firm. Trillion was sub-contracted to transnational consultancy McKinsey but was paid directly by Eskom without having done any work. He was finally placed on suspension only after the Development Bank of South Africa (DBSA) threatened to recall a R15 billion loan if Eskom took no action. Had it done so, other banks would have followed. Treasury then would have been on the line for R267 billion, as it has guaranteed a large part of Eskom’s debt. Brown and Eskom’s Board, however, took action only after Gigaba, in his new position as Finance Minister, insisted on it.⁷²

The irony could not be sharper. From his appointment as Minister of Public Enterprises in 2010, Gigaba played a pivotal role in ‘repurposing the state’, in the analysis of Swilling et al [2017]. On taking that office, as noted in Part 1 of this report, he announced that he would be an ‘activist’ shareholder and, in June 2011, sacked nine of the 11 non-executive Eskom Board members. Swilling et al argue that, “Repurposing the SOEs to become the primary

69 S’Thembile Cele, Setumo Stone And Msindisi Fengu, *ANC tells Lynne Brown: Dissolve Eskom board*, City Press, 14 May 2017.

70 African News Agency, *Molefe removed as Eskom CEO, board might go too*, Engineering News, 31 May 2017.

71 Sikonathi Mantshantsha, *Lynne Brown axes Chwayita Mabude from Eskom board*, Business Day, 23 June 2017; Paul Burkhardt, *Eskom Chairman Ngubane Quits Amid Probes, Management Turmoil*, Bloomberg, 12 June 2017.

72 Sabelo Skiti, Thanduxolo Jika, Kyle Cowan and Mzilikazi wa Afrika, *How top banks lit a fire under Eskom, Gigaba*, Sunday Times, 30 July 2017.



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mechanisms for rent seeking at the interface between the constitutional and shadow state became the strategic focus of the power elite that formed around Zuma” [12]. To this end, Gigaba set about “restructuring of SOE boards, which became broadly representative of ‘Gupta-Zuma’ interests” [12] – notably Eskom, Transnet and arms group Denel. And he ensured Molefe’s appointment as Transnet CEO.

Two points should be recalled here: First, that the project to create a black business class to lead national transformation was initiated in 1996 with Gear. With that, “the working class [was] forsaken as the agent of the National Democratic Revolution ...” [Chipkin 2003: 35]. However, the extreme concentration of South Africa’s economy limited entry to the halls of capital to a handful of BEE moguls – notably, the Motsepes, Ramaphosas and Sexwales – and calls for ‘inclusion’ gave rise to ‘broad based’ empowerment, the broad base of which is more symbol than substance.

Second, Eskom, Transnet and Denel were identified as key resources in the developmental state agenda announced in 2004. Gear’s assumption that private capital would lead investment in the economy had manifestly failed and the new idea was that the SOEs would drive investment and that private capital would follow the action. Eskom’s new build was represented as inaugurating this new direction. It was followed by the ‘new growth path’ (NGP), the ‘strategic infrastructure projects’ (SIPs) and the National Development Plan (NDP).

The worst of both strategies came together under Zuma as the logic of the developmental state was reduced to providing opportunities for looting. Swilling et al emphasise that state capture goes well beyond corruption. The “power elite” that have clustered around Zuma are not merely a criminal network but the proponents of a political project “akin to a silent coup” against the Constitution [2]. Repurposing the state is at the core of this agenda. It is about “reconfiguring the way in which a given state institution is structured, governed, managed and funded so that it serves a purpose different to its formal mandate”. This is not just for looting but also to consolidate and retain political power.



‘Radical economic transformation’ provides ideological cover to mask “private enrichment by reference to public benefit” [5]. The use of Bell Pottinger, a British, white and neo-colonial PR firm, to orchestrate the narrative framing of state capture by ‘white monopoly capital’ spices up the contradictions. As is usual with propaganda, that narrative has its truth. Its use, however, is distraction. It diverts attention from what the Zuptas are up to – but curiously also mirrors it: crony capital takes corrupt colonial capital as its model.

A key strategy in this project is the creation of a symbiosis between the constitutional state and the shadow state. That is, the Zuma group uses the formal rules of the constitutional state when it suits them and acts outside of them, mostly in secret, when it does not. It also uses organs of state, notably security agencies and the state prosecutor, against rivals for power inside or outside the ruling party. The prosecution of Gordhan in early 2017 is a case in point. Again, the strategy has its origin in Mbeki’s use of state agencies to fight party battles.

The Guptas’ role in constructing “a vast and powerful network that effectively brokered the process of state capture” is critical, according to Swilling et al. They could play this role precisely because they are outsiders. Being dependent on him, “they could ... be trusted to manage the shadow state transactions that Zuma required. They were loyal to him, not to any ANC faction or established business interest. They ... could make things happen ... with maximum deniability and limited culpability” [21].

The last ditch

On the 1st of March 2017, coal truck owners sent a convoy of about 100 coal trucks to blockade Tshwane. Coal trucks take a lot of space and initial reports exaggerated the scale of the protest. It was also reported as a drivers’ or a workers’ protest.⁷⁴ The protest, however, was coordinated by the bosses’ Coal Transporters Forum (CTF) whose spokesperson, Mary Phadi, controlled all messaging. Their statement headlined that it was “against government’s

74 Nqobile Dlodla, *South African coal truck drivers protest against renewables*, Reuters, 1 March 2017.



Box 9: Eskom – a short history written in smoke in the sky

Table 9: Eskom production, coal and carbon dioxide.

Year to March	2017	2016	2013	2012	2009	2008	2000
Production (GWh sold)	214 121	214 487	216 561	224 446	214 850	224 366	178 193
Coal burnt (million tonnes)	113.7	114.8	123.0	125.5	121.2	125.3	92.5
Carbon dioxide (million tonnes)	211.1	215.6	227.9	231.9	221.7	223.6	161.2

Source: Eskom Annual Reports.

The table shows the coal burn and CO₂ emissions rising and falling more or less in line with production. Between 2008 and 2012, emissions intensity actually increased. In 2017, it is a little down, probably because of the inclusion of REIPP power.

Production rose steeply from 2000 to 2008. In January 2008, Eskom hit the wall and power outages precipitated a national crisis and big industrial users were forced to cut consumption by 10%. The global economy was also in trouble and the financial meltdown followed in August that year. Demand crashed in the year to March 2009 and so saved Eskom’s spinning margin. It recovered in 2011 and 2012 as China’s massive stimulus programme stoked demand for coal, iron and other resources. From 2013, however, China was running out of stimulus steam. It was also facing rising social protest over the state of the environment and trying to contain the thickening pollution. Resource prices slumped again. Meanwhile, Eskom was again imposing rolling mass outages around the country as its overworked plant broke down. At the same time, it was pushing up the price of electricity to pay for the much delayed Medupi and Kusile.

In 2016, Eskom’s spinning margin was again saved as demand sunk below the levels of the crisis year of 2009. By this time, the first unit at Medupi was online and Eskom was spending more time on maintenance. Eskom



had 42 800 MW nominal capacity backed by 3 400 MW from REIPPs to meet 34 500 MW peak demand. The margin is widening fast. Ingula was commissioned in 2016. By March 2017, Eskom's nominal capacity was 44 100 MW but this included only one Medupi unit. A second has now been commissioned while a third is synchronising. One Kusile unit has also been commissioned and another is synchronising. That brings it to 47 000 MW backed up by 5 000 MW REIPP capacity. Peak demand was slightly up at 35 000 MW. That gives a spinning margin close to 50% against an industry norm of 15%.

Table 10: Eskom's sulphur, nitrogen and particulate emissions (tonnes).

Year to March	2017	2016	2014	2012	2008	2000
Sulphur dioxide	1 766 000	1 699 000	1 975 000	1 849 000	1 950 000	1 505 000
Nitrogen oxides	885 000	893 000	954 000	977 000	984 000	674 000
Particulates	65 130	78 370	78 920	72 420	50 840	66 080

SO₂ and NO_x emissions also rise and fall with production, except in 2014 and again in 2017 when SO₂ emissions increase despite falling production. Eskom does not tell us why but, in 2017, it is likely because of high sulphur emissions from the newly installed units at Medupi. Both Medupi and the neighbouring Matimba plant are exceeding their SO₂ Atmospheric Emissions Licence (AEL) limits as well as the minimum emission standards. This is Eskom's response: "An application to increase the SO₂ limit in the AEL will be submitted to DEA in the coming year."⁷³

Particulate emissions have increased substantially. There has been a reduction from 2016 to 2017 but emissions are still 15 000 tonnes higher than in 2008 despite much lower production. Eskom attributes the reduction to "increased opportunities for emission related maintenance and repairs done at stations during outages, together with a continued focus on managing emissions performance at individual stations". The neglect of 'emissions related maintenance' presumably explains why they increased in the first place. And it may be that Eskom by-passed pollution controls to maximise production when it was short of power.

⁷³ Eskom AR 2017: 61.



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multibillion Rand deals” with renewable IPPs.⁷⁵ It noted that electricity consumption had declined and Eskom had surplus capacity. It asserted that Eskom had to buy renewable energy at 214c/kWh in place of its own power produced at 32c/kWh and that it had to sell it at only 86c/kWh. This was costing the utility Eskom R9 billion a year. It then went on to protest that Eskom would have to close five power stations, 30 000 jobs would be lost and eMalahleni would be turned into a ghost town.

Government responded with unusual alacrity and from the top. A Cabinet statement on the very same day said it was “open to constructive engagement with the legitimate leaders of the coal trucking industry” and that the draft IRP 2016 made clear that coal would continue to be part of the energy mix along with renewables and gas.⁷⁶

This looked like Eskom was using the trucker owners as its proxy. First, the statement appeared to prioritise Eskom’s campaign against renewables over its own interest in trucking coal. Notably, there is no mention of the new coal rail to Majuba, due for completion in December 2017, which will have an immediate impact on trucking. Second, it repeated misinformation on prices recently put about by Eskom. Third, it bought Eskom’s line that the five plants – Komati, Hendrina, Arnot, Camden and Grootvlei – would close because of renewable IPPs. Fourth, it created the impression that the plants would be closed soon and all at once and pushed the unions into an angry defence of jobs.

Eskom’s campaign against renewable IPPs opened in mid-2015 when Molefe refused to issue budget quotes for grid connections and so stalled the REIPPPP. He said this was a temporary measure because Eskom’s current financial plan could not support any new IPP connections as well as energy – in other words, coal – purchases. It now seems clear that pretending good faith was camouflage for a strategy of disrupting the REIPPPP. The next year, Eskom upped the ante. Molefe complained that the performance of renewables was disappointing – apparently because solar PV does not generate after dark. Ngubane wrote to

75 CTF letter to the media house.

76 Statement on the Cabinet meeting of 1 March 2017.



the Minister of Energy saying the utility would not sign new power purchase agreements. Eskom then described this as ‘seeking clarity’ on how to proceed in the context of reduced demand.⁷⁷

Following Molefe’s departure, Koko added rank dishonesty to aggression. He put together a presentation that compared the costs of coal for Eskom’s power stations – power from pumped storage stations apparently costs nothing at all – with what Eskom pays for renewables, that is, the total cost including IPP profits.⁷⁸ Further, he used prices only from the first three bid rounds, which Eskom had already signed up. Prices fell sharply in each successive round and Eskom is refusing to buy the lower priced renewable electricity from rounds 4 and 4.5.

The coal truckers’ protest statement repeated Koko’s narrative. And Brown repeated it a week later. This is the basis on which they claimed that Eskom produces power at 32c/kWh. In contrast, Eskom’s 2016 Annual Report shows costs per kWh, including depreciation and amortisation, as 72c/kWh. Excluding depreciation, it is 64c/kWh.⁷⁹ The last renewable bid round (round 4.5) was in early 2015 and both solar PV and wind were priced at 62c/kWh.

Nor is it true that Eskom was buying at 214c/kWh and selling at 84c/kWh. Eskom’s revenues are determined by Nersa and, for the four years to March 2017, Nersa allowed Eskom R38.5 billion for the purchase of energy from the renewable IPPs. This cost is factored into Eskom’s tariffs. In the event, it spent R30.9 billion and has thus ‘over-recovered’ R7.6 billion. Mike Levington, of the South African Photovoltaic Industry Association (SAPVIA), observes that this money will eventually be ‘clawed back’ under the ‘regulatory clearing account’ mechanism – which adjusts for under- or over-recovery. Effectively, that means that future tariff increases will be reduced. For the time being, however, Eskom has the benefit of the money. Eskom also benefited from

77 News24Wire, *Molefe: Eskom budget can't support new IPPs*, Engineering News, 20 October 2015; Terence Creamer, *Molefe's negative renewables comments attract yet more criticism*, Engineering News, 16 May 2016; Carol Paton, *Eskom cuts off private power*, Business day, 21 July 2016; Terence Creamer, *Eskom letter sends shock waves through private power sector*, Engineering News, 21 July 2016; News24Wire, *Eskom backtracks, wants review of green energy project*, Engineering News, 29 August 2016.

78 Matthew le Cordeur, *Koko unpacks Eskom's renewable costs, but experts disagree*, Fin24, 17 January 2017.

79 Eskom Annual Report 2016: p.124.



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reduced spending on diesel when it was overworking its peaking power plant in an effort to reduce load shedding in 2013-14. All told, rather than losing R9 billion a year, Levington calculates that Eskom now has R22 billion more in its pocket than it would have without the REIPPs.⁸⁰

Eskom made no statement on plant closures and did not consult or inform workers – or anyone else – before the coal truckers’ protest. Indeed, it has still not posted any formal statement on its website. After a week of confusion, Eskom’s spokesperson finally responded to media questions. He “confirmed that the power utility will expedite plans to close four power stations in order to accommodate renewable independent power producers (IPPs)”. Two units at Komati were already shut down and Hendrina would close by December 2018.⁸¹ Two weeks later, he said five stations would close, but omitted Arnot and included Kriel. He said four of them would be closed in the next five years and Grootvlei would be closed in the next 10 years.⁸² He made no mention of the large additions of power from Medupi and Kusile.

In March, three units at Medupi and Kusile were operating at full power. Since then, two more have been synchronised to the grid.⁸³ Each of them will produce more power than the whole of the Komati plant. Together these five units will produce around 30 000 gigawatt hours (GWh) a year. Assuming that both plants are completed, they will produce over 70 000 GWh. The five power stations on the closure list produce around 45 000 GWh.

By comparison, Eskom bought 9 000 GWh from renewable IPPs in 2016. This is significant but not on the same scale as Eskom’s big new plants. Hence, if plant closures are ‘expedited’, it will be to ‘accommodate’ Medupi and Kusile on top of declining demand.

Plant closures have in fact long been scheduled. This is because the plants are getting to the end of their 50-year design life and are increasingly expensive

80 Terence Creamer, *Eskom has over recovered R7.6bn in renewables-related costs since 2014*, Engineering News, 7 July 2017.

81 Antoinette Slabbert, *Eskom to close four power stations: ‘Only option to accommodate renewables’*, Moneyweb, 8 March 2017

82 Charlotte Mathews, *Eskom’s coal-fired power struggle*, Financial Mail, 23 March 2017.

83 Sikonathi Mantshantsha, *Eskom reserves boosted as Medupi and Kusile units plug in*, Business Day, 7 July 2017.



to run. The Department of Energy's (DoE) draft Integrated Resource Plan (IRP 2016) shows the first units at Camden and Hendrina closing in 2020 with Arnot beginning to close the next year. The DEA says that closures are part of Eskom's air pollution reduction plans required for stations that will not meet minimum emission standards.

Eskom itself, however, has been reluctant to give closure dates and repeatedly suggests that it will extend the life of old plants. On the 31st of March, Brown called on Eskom to do a socio-economic assessment of plant closure to which Koko immediately responded: "We hope that, once the studies are complete and we see the social and economic impact for those plants, we will think twice and we will put all our efforts into ensuring that we don't close these power stations." He said the Board had endorsed a fleet-renewal strategy to extend the life of the existing power stations from 50 to 60 years.⁸⁴ As yet, there has been no response to requests by environmental organisations to participate in that assessment.

The coal truckers are not waiting for the results. At the end of June, they applied to the courts for an order prohibiting Eskom from signing any more power purchase agreements with renewable IPPs. This matter is still to be heard. Eskom is named as the first respondent but, whatever its public response, it seems evident that it would welcome such a ruling. The other respondents are Nersa, the Minister of Energy, and 35 renewable IPPs with projects awaiting Eskom's signature. In their founding affidavit, the truckers repeated their claim that Hendrina, Arnot, Camden, Grootvlei and Komati power stations would have to shut down in consequence of the REIPPPP. However, they now claimed that "over 1 000 000 permanent jobs will be lost by Eskom and its associated suppliers." It might be charitable to believe that this was a typo.

Workers are, of course, concerned at the possible loss of jobs and the unions were angry at not being consulted on possible closures. Following the truck owners' action, Cosatu and NUM called any decision to close plants "a hostile act of provocation directed at workers and their unions".⁸⁵ By mid-March,

84 Terence Creamer, *Eskom to fast-track socioeconomic assessments for five coal stations facing closure*, Engineering News, 30 March 2017.

85 *Shutting of power stations is 'hostile act' by Eskom, Cosatu says*, Business Day, 7 March 2017.



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both NUM and Numsa were threatening strike action. NUM said 10 000 power station jobs and 40 000 jobs in the surrounds, including mining, were at stake. Numsa said 30 000 jobs.

As with costs, the job numbers apparently come from Eskom and are inflated. Our estimate is between 12 000 and 15 000: between 5 000 and 6 000 jobs in the five power stations, up to 200 truck drivers and between 6 000 and 9 000 mineworkers. At the same time, it is likely that Eskom would transfer power station workers from these plants to Kusile or Medupi. Kusile's coal demand is also very large. It was intended that Anglo's New Largo would supply it by conveyor belt but the mine has not been developed because of the standoff between Eskom and Anglo noted in Part 1. Until it is developed, coal will have to be trucked in from elsewhere. Indeed, given that the Highveld coal fields are in decline, it may be that Eskom needs to close some plants so as to divert coal to Kusile.

It nevertheless remains the case that many jobs are threatened and, as the unions emphasise, this is in a context of economic recession and widespread job losses and high unemployment.

NUM noted the need to reduce greenhouse gas emissions but "that should not result in retrenchments". Numsa said it could not "allow Eskom and this government to destroy the livelihoods of thousands of workers and their families".

Cosatu and NUM considered that the REIPPPP was about privatising Eskom "through the back door". Beyond that, the NUM repeats Eskom's story board: renewables are unreliable, cannot replace baseload power, are more expensive than coal, will result in wholesale retrenchments and will not create many jobs. Numsa similarly repeats Eskom's figures on the costs of production.⁸⁶

The backlash against the REIPPPP focuses on the process rather than on renewables as such – although it is striking that the coal baseload IPPs

⁸⁶ NUM News, *NUM's position on the decision taken by Eskom board to shut down five Power stations to accommodate Independent Power Producers (IPP's)*, 5 March 2017; *Numsa fumes over Eskom plant closure plans*, eNCA, 17 March 2017; *Numsa threatens 'mother of all strikes' if Eskom closes plants*, eNCA, 17 March 2017; NUM Press Statement, 29 March 2017 (on Independent Power Producers).



(BLIPPs) are not mentioned. Cosatu noted that government has made no plans for a just transition: “Eskom and the government should suspend their plan to shut down the power stations until a just transition solution is arrived at by all affected stakeholders.”⁸⁷ Numsa sees the response to climate change being managed in the interests of global capital. “To satisfy the north, the ANC-led government ... were quick to make energy commitments to reduce emissions by moving to renewables. They did this without advancing the interests of the South African working class such as by demanding that all technology used on renewables should be produced and manufactured locally.”⁸⁸

The 2015 groundWork Report raised similar concerns. We noted that “government now sees renewables as the business of private IPPs” and that the REIPPPP process “is custom made for transnational corporations” [109, 111]. On a technical level, however, it delivered impressive results. And Eskom’s stalling of the programme also affects jobs. The following numbers from McDaid [2016] are for the first four bidding rounds. The programme, however, was stalled at the end of the third round so some of these jobs will be in suspension.

As with other projects, there are more jobs in construction than in operations. For 92 projects in the first four bidding rounds, McDaid shows 43 749 ‘job years’ for construction. Most projects are built within two years so that amounts to just over 20 000 jobs. There are 55 277 ‘job years’ for operations over 20 years making 2 760 jobs. In construction, around 50% of jobs went to people from the local community. And there are 2 129 permanent operational jobs for local people in 76 projects in the three Cape provinces. This does not include ‘indirect’ jobs such as security guards. Data for the rest of the country was not available [21].

As Numsa notes, a core issue is where the technology and components are made. Local manufacture requires a pipeline of local projects to supply. Given that the REIPPPP was barely four years old when Eskom stalled it, this is an infant industry sector. McDaid documents the establishment of

87 *Shutting of power stations is ‘hostile act’ by Eskom, Cosatu says*, Business Day, 7 March 2017.

88 Irvin Jim, *Numsa demands a socially owned energy renewables programme*, Daily Maverick, 5 May 2017.



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six manufacturing firms with a total of over 750 permanent jobs. Further investments were reported with prospects for around 3 000 jobs. Firms are feeling the pressure of competition from cheap imports from China but the stalling of the REIPPPP is the more serious issue. Factories where Numsa members are organised are already closing.⁸⁹

In June 2017, Cosatu gave notice at National Economic Development and Labour Council (Nedlac) that they would organise a national one day strike “to stop government from buying renewable energy at the expense of jobs and as an excuse to privatise Eskom”. It reiterated that “the economy should reduce reliance on fossil fuels and increase the use of energy from water, sunlight and wind. However, transition to a low carbon economy must be just and must address the issue of who owns and controls these sources of energy and how local production and jobs will be created”.⁹⁰

This sounds the right notes from Cosatu’s policy on climate change. Over a period of 5 years from 2009, the federation engaged with its affiliate unions to produce a creative and serious vision of a just transition in response to the crisis. Numsa, while still a member, participated in the Cosatu policy process and went on to develop highly influential climate positions. Its call for socially owned renewable energy echoed around the world. And it distinguished between state ownership and democratic control at Eskom. These initiatives have not been sustained. The politics that have torn apart both Cosatu and the ‘tripartite alliance’ with the ANC and SACP have left the labour movement in disarray.

The proposed action is in defence of coal jobs in mines and plants that are at the end of their life. It is not an action for a just transition. It demands of Eskom precisely what Eskom wants: to ‘suspend’ IPP contracts and not sign new ones. But Eskom will close the plants at its convenience.

Eskom published its Annual Report in July. It confirms much of what we argued above: Eskom has substantial surplus capacity caused by declining demand,

89 Terence Creamer, *IDC hopes to salvage wind-tower plant, but warns liquidation can’t be ruled out*, 8 February 2017.

90 Cosatu notice to Nedlac, 21 June 2017.



fewer breakdowns, the first units of Medupi and Kusile finally coming on line, as well as the contribution of renewable IPPs. It says:

Due to the surplus capacity and the age of some of our coal-fired power stations, some stations may have to be decommissioned earlier than originally anticipated ... operating costs will also reduce as activities are ramped down during the decommissioning period. Staff will assist with the decommissioning and thereafter be absorbed in other areas of the business. The dismantling of plant and rehabilitation of coal mines will have a significant cash flow impact.⁹¹

Hence, redundancies will be limited. Eskom says decisions on decommissioning are yet to be made and some plants may be kept on standby. However, it plans to put the plants that are most expensive to run in 'lean preservation', that is, available for recall. It gives the following schedule: Hendrina in 2018/19, Grootvlei in 2019/20 and Komati in 2020/21. And it already has units in 'cold reserve' – available at 12 to 16 hours' notice: up to six units during the week and up to 14 at weekends. Some units are in 'extended cold reserve' – available at five days' notice.⁹² There is a total of 25 units at these three plants.

At the same time, Eskom is trying to drive up demand in much the way that it did following the over-build of the 1980s. It has applied to Nersa to authorise cut rate power to big industries, particularly the metal smelters even as it has put in an application for a 27% increase in the tariff to municipalities – and hence to households.⁹³

91 Eskom Annual Report (AR) 2017: 14

92 AR 2017: 47 and 49

93 Terence Creamer, *Power-intensive firms back Eskom proposal for new pricing deals*, 7 April 2017; Business Day Editorial, *Eskom: dynamo of cynical spin*, 20 July 2017.



Sasol

Sasol was established as a state owned corporation in 1950. Alongside Eskom and Iscor, it was at the centre of a massive industrial expansion following World War II for which the Industrial Development Corporation (IDC), “set up in 1940 to encourage secondary industrialisation”, was the key funding agency [Fine and Rustomjee 1996: 159]. Iscor, the state owned steel corporation, was established at the same time as Eskom in the late 1920s. In 1948, it started construction of the huge Vanderbijlpark steel works and a whole new town with townships and hostels to house the workers.

Sasol – the South African Oil and Gas Corporation – followed shortly after. As with Vanderbijlpark, the new coal-to-liquid ‘synfuel’ company required a greenfield site – previously farm land – to construct its massive industrial plant without the constraint of having to fit into an already built environment. It also required the location on top of the main Vaal coal fields and close to a copious supply of water. Across the Vaal River from Vanderbijlpark, Sasolburg made the southern point in what came to be known as the Vaal Triangle. These were the first of South Africa’s ‘mega-projects’ and, as Fine and Rustomjee argue, focused investment on the expansion of the minerals-energy complex.

These industries modelled themselves on the ‘Fordist’ factories of corporate America. This meant increased control by management over the labour process, via continuous or assembly line production where machines, not artisans, set the pace of work. Both Iscor’s integrated steel production plant at Vanderbijlpark and Sasol’s liquid fuel-from-coal plant at Sasolburg introduced this new style of work. In South Africa it was given a racial twist, as this snippet from a trade magazine in the mid-forties illustrates: “... the only way to bring a native into industry was to put him on a conveyer belt, where if he stopped working for a moment something red-hot fell on his foot” [quoted in Webster 1985: 85]. These massive plants were made the centre of a larger system of ‘vertical integration’ of production under the control of the corporation. This meant controlling the entire chain of production from raw material inputs to final product.



Building Sasol with its own coal mines and its own town required very large capital investments. Nobody in fact knew what it would cost as the technology, the Fischer-Tropsch process, had not been applied commercially anywhere in the world. Estimates grew from £18 million in 1951 to £33 million in 1953. By 1956, the IDC had invested £40 million into Sasol, 77% of its total industrial investments, and costs were still rising. The parliamentary opposition was outraged by this bottomless pit of spending and even the National Party economic minister, Klasie Havenga, was distressed:

I am very disappointed that Sasol's capital requirements have increased to such an extent and would probably not have approved of the scheme had [I] visualised that the cost would reach such dimensions [quoted in Clark 1994: 160].

The project made some sort of sense in the immediate post-war period as rising oil demand in the industrial countries was matched by anxieties over supply shortages. The state was also anxious to find ways of using the large resource of low grade coal and concerned to save on fuel imports and so conserve limited foreign exchange. The mining house, Anglovaal, already had some experience in trying to press oil from shale and the Smuts government planned to support it in developing a coal-to-liquids project. For a project with high capital costs and uncertain returns, however, Anglovaal wanted more state support than was on offer. It saw better prospects on the Free State gold fields and dropped the project. The newly elected National Party government then resolved to establish Sasol with state ownership.

By the mid 1950s, the post-war oil shortage had turned into a supply glut which threatened to evaporate the price of oil and the profits of the big oil corporations. Mobil's refinery in Durban, the first crude oil refinery in the country, was completed in 1954 and cheap fuel was imported by the other majors. Government could then either abandon its already huge investment in Sasol or keep spending. The confidence of Sasol's founding director, Etienne Rousseau, was perhaps decisive. A chemical engineer who had been involved in Anglovaal's original project, Rousseau built an organisational culture centred



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on high technology innovation and fierce loyalty which translated well into apartheid's self-aggrandising narrative of racial superiority. Sasol became a symbol of Afrikaner nationalist modernisation.

Two thirds of the capital cost of Sasol went to the gasifiers and plant to make oxygen and steam – not needed in a conventional refinery – and the extraordinarily high energy process of production is high cost even in the context of cheap labour and coal. It is inherently uncompetitive unless crude oil prices are high and was heavily subsidised from first production in 1955. It became suddenly and unexpectedly profitable in the early 1970s when the oil shocks multiplied the price of oil.

Sasol also led the mechanisation of coal mining in South Africa as its plant required a constant and voluminous feed of coal, both for productivity and for operational stability, at a time when half of South Africa's coal was still hand mined. Much of the synfuels plant itself was also experimental. Originally based on German and American technologies, it was extensively redesigned to the point where Sasol was taking out new patents. This learning, bought at public expense, was accompanied by a succession of incidents. Several reactor units burnt down while repeated “explosion and deaths occurred at the gasification and units downstream from the reactors too” [Collings 2002: 51]. Regular incidents also took the lives of mine workers – part of the pattern that made black lives cheap in order to keep coal cheap.

Sasol seriously underestimated the volume of its effluent, producing five times more than its first treatment plants were designed to handle, according to Meintjes [1975]. It disposed of the surplus by irrigating it into farm land, leaving soil bacteria to break it down. The resulting stench was known as the ‘Abrahamsrust smell’ after the name of the farm. It eventually expanded its treatment works sufficiently to deal with the smell, but it continued ploughing waste sludge into the ground into the 1990s.

Similarly, air pollution was utterly neglected until 1967 when Sasol began to address the most offensive and most visible emissions – hydrogen sulphide⁹⁴

94 Sasol generally represents hydrogen sulphide as an odour problem. Its health impacts are well documented, however [e.g. Elsom 1987, Hamilton and Hardy 1983]. Intense exposure can lead to respiratory injury or death while exposure to lesser concentrations can cause eye and respiratory irritation.



and smoke. In 1973, The Star trumpeted that, “Sasolburg was no longer under a shroud of smoke and dirt” and dutifully echoed Sasol’s own claim that “no harmful or dangerous concentrations of gases or solids are emitted from the Sasol plant” [quotes in Meintjes 1975: 137ff].

That this absurd claim was allowed credibility indicates that environmental issues were entirely subordinate to the heroic story of industrialisation. The costs of Sasol’s financial subsidies were questioned, but its environmental costs were scarcely recognised. In the very act of dealing with visible pollution, a monstrous slate of emissions was excluded from public discourse.

Sasol 2 and 3

Crude oil refining was expanded in the 1960s, with Shell and BP jointly constructing Sapref next to Mobil’s refinery in Durban and Caltex building in Cape Town. The apartheid government, meanwhile, was becoming increasingly edgy about fuel security as the Sharpeville massacre provoked calls for an international oil embargo. In response, it organised the construction of Natref in Sasolburg – a partnership between Sasol, Total and the Iranian National Oil Company – while the state railway company started developing the network of pipelines linking Natref to the coast and also to the secret oil storage facility at Ogies.

In response to US support for Israel’s war against Egypt, the Arab states cut production and induced the first ‘oil shock’ in 1973. They also imposed an actual embargo, leaving South Africa almost wholly “dependent on Iran (which had declined to enforce the embargo) for crude oil supplies (91% in 1979)” [Marquard 2006: 249]. While apartheid paranoia rose sharply, so did the price of oil and Sasol’s coal-to-liquids suddenly looked profitable. In 1975, it agreed with government to build Sasol 2 on top of the large, low grade coal fields of what was then called the Eastern Highveld. As with Sasolburg, it built a new company town and signalled this relationship in the name: Secunda.

The second oil shock followed the overthrow of the Shah of Iran in 1979. The oil price spiked again and the revolutionary government abruptly cut oil exports to South Africa. Government then ordered the construction of Sasol 3, identical to Sasol 2 and built alongside it. The priority given to the project was



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reflected in rapid construction. Sasol 2 was completed in 1980 and Sasol 3 in 1982. Sasol simultaneously constructed the world's largest underground coal mining complex to produce the 39 million tonnes that the new plants would devour each year. The two plants produced ten times more than the Sasolburg plant, which subsequently phased out synfuels to focus on chemicals, enough to supply half of South Africa's liquid fuel demand. At Sasolburg, meanwhile, all refurbishment was halted until 1980, leaving the complex more prone to accident. The plants also consumed energy on a massive scale. Sasol's own steam house generated 500 MW while Eskom supplied another 400 MW and built Kriel Power Station "specifically for that purpose" [Fine and Rustomjee 1996: 80].

Sasol 2 and Sasol 3 cost R7 billion, providing a major boost to the recession-hit engineering sector. This was a staggeringly large sum so government privatised Sasol in 1979 to raise the capital. With oil prices rocketing and a government guarantee of profits to Sasol, the offer was oversubscribed. Marquard observes that South African business and the financial press were "ecstatic". The Financial Mail was crowing:

Sasol is the ultimate V sign to the world's sanctions threat, with the added advantage that it will be profitable too. Furthermore, it is the first major public corporation in which government has carried out its promise to reduce its involvement in the economy. [16 November 1979, quoted in Marquard 2006: 303]

Government nevertheless retained a substantial stake in the corporation through the IDC.

The new plant had a major impact on the oil refineries which were forced to cut production and mothball plant to accommodate Sasol's production. Throughout the 1980s, the oil multinationals were well compensated for this. Government also delivered subsidised profits through the regulated price of petrol to buy their close collaboration with sanctions busting and to dissuade them from disinvesting. In the event, under pressure in the US, only Mobil withdrew from South Africa. It sold its refinery and petrol stations to Gencor



in 1989 and the business was rebranded as Engen in 1993. It was subsequently sold to Petronas, Malaysia's state owned oil corporation. The industry as a whole, and Sasol in particular, was protected from public scrutiny by a wall of secrecy throughout this period.

Sasol in the transition

Sasol remained intimately linked with the state both before and after the political transition. Before privatisation, it had acted as a virtual arm of the state. Following privatisation, some functions, such as management of the strategic oil reserve, were handed over to state bodies. But Sasol was central to government policy and, together with government, it effectively coordinated the petroleum industry's response to the oil embargo.

With sanctions lifted, Sasol repositioned itself as a transnational corporation in its own right. It listed on the New York Stock Exchange and made major investments in Europe, the US, China, the Middle East and Africa. This expansion was made possible by the massive accumulation of subsidies at public expense, not to mention the additional subsidy of being allowed to pollute.

The state retained a major share in the corporation through the IDC and the Public Investment Corporation (PIC) and the link between Sasol and state strategies remained tight. Thus, the IDC invested heavily in Sasol's Mozambique gas pipeline, an investment justified in terms of regional policy, and Sasol presented itself as a key partner in the New Partnership for Africa's Development (Nepad) initiated by Mbeki. The state also portrayed Sasol as a paragon of technology innovation and hence as a key national asset for industrial development.

Subsidised profit

When Iran cut supplies and the oil embargo started to bite, the state itself took over procurement of oil "from secret sources at a premium, and sold it at international market rates to the refining companies" [Marquard 2006:



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249]. In other words, the state picked up the cost of evading the embargo. At the same time, it guaranteed corporate profits by regulating the price of fuel in relation to the supposed costs of importing oil.⁹⁵ As part of the deal, the transnationals were required to buy Sasol's synfuel to blend with their refined crude oil products while Sasol was restricted to a few symbolic pumps and could not develop a significant retail market. Industry regulation has thus centred on pricing and the use of Sasol's synfuels. The pricing mechanism is now somewhat modified, to give a less exaggerated value to import costs, but is still in place.

With the second oil shock, following the overthrow of the Shah, prices hit a record high in early 1980 but then quickly declined before collapsing in 1986. Apart from a brief spike when the US invaded Iraq in 1991, the price stayed low to the end of the 1990s. At such low prices, Sasol's synfuel is hopelessly uncompetitive and, from 1989 to 2000, it enjoyed nearly R8 billion in subsidies paid out of the 'fuel equalisation fund'. Sasol was paid from the fund when the oil price fell below a benchmark figure (US\$23 a barrel in 1995), and was supposed to pay back into the fund if it rose above a second benchmark (US\$28 in 1995). In 1996, government announced that this subsidy mechanism would be phased out. The last subsidy payment was made in 1999. Crude prices then rose steeply, ranging between \$60 and \$80 a barrel in 2006. In this context, the competitive relationship between synfuels and oil products is reversed because Sasol controls its own supply of cheap coal and is insulated from rising global energy prices.⁹⁶ It thus enjoyed windfall profits guaranteed by the oil based pricing mechanism. According to Sasol, however, the equalisation mechanism had lapsed so it did not have to repay the subsidy.

Government did not necessarily share this view. In 2000, it initiated a review of the equalisation mechanism which was not made public but apparently recommended that the mechanism be retained – in other words, Sasol should pay back the subsidy. This was revealed in the report of a 2006 Treasury

95 The calculation of the 'landed price' is obscure and contains a number of fictional costs which turn into guaranteed profits for the oil refineries.

96 The oil super-majors are, of course, making super profits from crude oil but their refineries in South Africa still have to pay the going rate.



investigation into whether Sasol should be slapped with an additional tax on windfall profits. According to this report, the equalisation mechanism was in fact based on a gentleman's agreement. "When in 2003 Sasol believed that it no longer required tariff protection it refused to reintroduce such a 'gentleman's agreement.'"⁹⁷ The report also made clear that Sasol Synfuels and Natref secured numerous hidden subsidies besides the equalisation and pricing mechanisms.

Sasol's response suggested that more subsidies might be appropriate. It argued that the international trend was to provide incentives for 'alternative fuels' and that its subsidy paled besides those given to defence industries – R200 billion, mostly paid before 1994 – and the motor industry – R90 billion paid out through the Motor Industry Development Programme.⁹⁸ In all, it said, the state had paid out some R334 billion to industry between 1989 and 2000.

Treasury apparently accepted the argument for 'alternative fuels'. It dropped the windfall tax when Sasol committed to developing Project Mafutha, an all new 80 000 barrel-a-day coal-to-liquid (CTL) plant which would require a whole new Sasolburg. The Waterberg, where Eskom was already polluting the air, was the favoured site. Being a dry area, CTL's exorbitant water demand could only be met through massive cross water-shed transfers.

However, as Nair et al remark, "Having headed off the possible windfall tax, it appears that certain projects will not be pursued without very substantial participation and support from the state" [2015: 14]. But Sasol did implement Project Turbo to expand production at Secunda by 20%, taking the synfuels plant capacity to 180 000 barrels a day.

97 Quoted by Kevin Davie, *The clawback, which wasn't*, Mail and Guardian, August 4 to 10, 2006. The information on subsidies is mostly based on a number of articles by Davie in the Mail and Guardian: *Govt's R6bn gift to Sasol*, September 23 to 29, 2005; *From Ogies with love*, August 4 to 10, 2006; *No windfalls here*, August 18 to 24, 2006. See also Hallowes 2005.

98 The MIDP is described in The groundWork Report 2003: 71ff.



‘Deregulation’

Deregulation⁹⁹ of liquid fuels, under the 1998 policy banner of competition and industrial restructuring, envisaged a three phase ‘managed transition’ to “allowing market forces to set prices” in phase 2, with government monitoring and measures to correct market failures in phase 3.

Phase 1 centred on terminating the requirement that the oil majors purchase Sasol’s product and allowing Sasol independent access to the market. Sasol then proposed a merger with Engen, together with their respective BEE partners, to form a new company called Uhambo. Uhambo would include the Engen refinery, Sasol’s share of the Natref refinery, the liquid fuels produced by Sasol Synfuel, and the combined retail network in Africa. It would give Sasol access to petrol stations and secure Engen’s supply of product.

The other oil majors – BP, Shell and Caltex – opposed the deal at the Competition Tribunal and, in February 2006, the Tribunal refused to allow it. It found that Uhambo would :

- dominate the market with about one third of all petrol stations;
- control most inland refining capacity and also the existing pipe-lines from Durban;
- entrench a system of import parity pricing – albeit one sanctioned by government through the pricing mechanism – that enables Sasol to reap the windfall profits from the difference between its costs and high priced oil imports.

Phases 2 and 3 of the restructuring have apparently been abandoned. At the Uhambo hearings, DME officials indicated that the pricing mechanism would be maintained well beyond 2010 to guarantee petroleum profits so that Black Economic Empowerment (BEE) partners would be able to pay for their shares. Business Report’s Ann Crotty then calculated that “consumers are paying about R594 million a year towards the cost of empowerment ... a cost that is

99 Deregulation is the word used in the policy. Reregulation would perhaps be more accurate since government would effectively empower a limited number of very powerful corporations.



generally carried by the shareholders of companies.”¹⁰⁰ In 2016, Sasol reported that the debt on the shares of Sasol Oil’s BEE partner, Tshwarisano, “has now been settled well ahead of the anticipated timelines” and Tshwarisano received a dividend of R356 million.¹⁰¹ In contrast, Sasol Inzalo, a BEE shareholder vehicle, was under water – with more debts than assets – and losing money. It is not clear how Sasol Coal’s partner, Sasol Ixia, is doing.¹⁰²

Its ‘transformation objectives’ are critical to its ‘social licence’, according to Sasol: “Failure to meet [them] could have material consequences for Sasol’s reputation, access to resources, permits and our licence to operate, as well as our ability to attract and retain skills.”¹⁰³ South Africa’s big corporations have been anxious to create a black business group ready to defend industry interests and to take the political offensive to legitimise profits. Sasol’s BEE vehicles are closely identified with it and come with high profile political clout.

Chemical high-tech

Sasol is the poster boy of South Africa’s industrial strategy. Having developed the only commercial CTL plant in the world together with a string of heavy chemicals plants, it is now positioned as a global technology leader. It is active in 35 countries and linked into global production networks through partnerships with a range of leading transnational corporations, including ChevronTexaco, and state-owned corporations such as Qatar Petroleum. Its exports are founded on high-value chemical-design services as much as on the export of commodities – primarily coal and heavy chemicals.

In the 2000s, the corporation made hay in the global sunshine of high oil prices. Apart from Project Mafutha in South Africa, it was investigating CTL plants with local partners in China, India and Indonesia. In the US, it was lobbying for government handouts for new synfuel plants. The oil price collapsed with the meltdown on Wall Street in 2008, dropping from a peak of US\$144 a barrel in

100 Ann Crotty, *Fierce rivalries keep powerful oil players in check*, Business Report, November 2, 2005

101 Sasol Annual Report (AR) 2016: p.4. Sasol has followed industry fashions in renaming annual reports as Integrated Reports or Annual Integrated Report. We are sticking to Annual Report to save confusion.

102 Justin Brown, *Sasol BEE partner settles debt*, City Press, 13 March 2016.

103 AR 2016: 48.



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July to \$34 in December. It took three years of volatile trading to recover and, from 2011, the price mainly bounced between \$100 and \$120. Sasol noted the European debt crisis, slowing growth in China and ‘softening’ commodity and chemicals prices. It determined on “prudent investment decisions” which meant reining in the expensive CTL projects but focusing instead on gas-to-liquids (GTL). A year later, Sasol abandoned the CTL projects “to focus singularly on accelerated GTL growth” but now framed this as a response to climate change.¹⁰⁴

Sasol has looked to GTL to ‘monetise’ gas resources since the turn of the century. Its Oryx plant, a joint venture with state-owned Qatar Petroleum, was constructed between 2003 and 2007 and was the world’s largest until Shell built the neighbouring Pearl plant. It also partnered with Chevron in the Escravos GTL plant in the Niger Delta, started in 2005 and not yet operating at full capacity. It has bailed out of a third partnership, with Uzbekneftegaz and Petronas, to build a GTL plant in Uzbekistan.

Sasol is evidently betting its future on the USA where it is putting 70% of its capital expenditure budget into expanding its Lake Charles chemicals plant. At home with the oil and gas lobby in America’s deep south, Sasol has garnered lush subsidies from the Louisiana state government.¹⁰⁵ In 2016 the project was 50% complete but US\$2 billion over the original budget of \$9 billion. The plant will produce various forms of ethylene and polyethylene plastics from cheap fracked gas. Sasol intends following this with a new GTL plant, also using fracked gas as a feedstock and making Lake Charles into “an integrated, multi-asset site similar in concept to our flagship Secunda facility”.¹⁰⁶ GTL is the next most carbon intensive option after CTL and, because fracked wells have a propensity to leak methane, the combination may be worse.

Closer to home, Sasol is exploring for oil and gas offshore and onshore in Mozambique and also off both the east and west coasts of South Africa. It developed the Pande and Temane gas fields in Mozambique in the late 1990s

104 Sasol Annual Report 2012: 11 and 2013: 9.

105 Office of the Governor, State of Louisiana, *Governor Jindal and Sasol Announce Largest Manufacturing Investment in Louisiana History, Creating Over 7,000 Direct and Indirect Jobs*, 5 December 2012.

106 Sasol Annual Report 2016: 103.



Box 10: Environmental racism in the USA

Sasol has been embroiled in a fight about the buy-out and relocation of Mossville, Louisiana, in the US, a community settled by freed slaves in 1790. Mossville is surrounded by 14 industrial facilities. In 1998 the US EPA found very high levels of toxins in the air. Another study, reported the Mother Jones magazine in 2014, said that 84% of residents suffered from central nervous system disorders.

Sasol is irritated by the negative publicity. It says it is being generous and buying properties, after being approached by residents, at much more than their value under a voluntary scheme. Some Mossville residents have opted to sell. Others are resisting and accuse Sasol of environmental racism. An analysis of Sasol's Lake Charles Project by the Louisiana Department of Environmental Quality predicts that it will result in significant increases of emissions of greenhouse gases, sulphur oxide, nitric oxide, and carbon monoxide.

See <http://www.motherjones.com/environment/2014/03/sasol-mossville-louisiana/http://www.motherjones.com/environment/2014/03/sasol-mossville-louisiana/>

together with a pipeline to Secunda and on to Sasolburg where gas supplements the depleted coal feedstock. It is expanding both gas production and pipeline capacity and using gas for power production as well as feedstock. Coal remains the primary feedstock at Secunda, where Sasol's original mines are mined out and have been replaced over the last five years by three new mines. Sasol says this "will deliver low-cost feedstock ... to at least 2050".¹⁰⁷ At the same time, Sasol is expanding both its synfuels and its chemical production capacity at Secunda.

In the second half of 2014, the oil price again collapsed to \$45 a barrel and again in 2015 to \$29. Sasol put together a 'Response Plan' at the end of 2014. It built on earlier cost cutting measures to reduce the number of permanent workers by 15% and slash contractor numbers [see chapter 1]. Operating profits (before interest and tax) plunged from R46 billion in 2015 to R24

107 AR 2016: 93.



billion in 2016. This included R10 billion lost on a Canadian shale gas fracking project.

Table 11: Sasol production and emissions

Year to June 30 th .	2016	2014	2012	2009	2008	2002
Production (Mt)	18.8	22.0	25.3	22.0	24.2	20.4
Greenhouse Gas (Mt)	69.2	72.3	76.4	71.5	76.1	71.1
Sulphur Dioxide (kt)	223	223	202	233	225	283
Nitrogen oxides (kt)	156	159	155	160	166	168

Sasol's production rose ever higher from 2002 to 2008, slumped in 2009 but recovered quickly in 2010. It reached an all time high in 2012 but has been going downhill ever since, with 2016 production well below the meltdown year of 2009. Emissions have followed the ups and downs of production with little real improvement over time and certainly not enough to make a difference to the neighbours or to the Highveld air.

Calculating climate

Rebranding itself as an environmental leader is perhaps Sasol's greatest innovation. Within the discourse of ecological modernisation – the World Bank's version of sustainable development – it has indeed made significant improvements, but off an appalling base. At Secunda, for example, its 'VOCs abatement programme' will reduce VOCs emissions by 80% from 2009 levels but that still leaves about 40 000 tonnes emitted to air every year. And that does not include methane emissions currently stated as 119 000 tonnes a year.¹⁰⁸ The essential problem for Sasol is that its processes are inherently energy, carbon and pollution intensive.

In 2006, Sasol ran comparisons of GTL and CTL with conventional oil refining. For GTL, it acknowledged that production is more energy-intensive than oil refining but claimed that the superior performance of GTL fuels offsets higher carbon emissions at the plant. Over the life cycle of production and

¹⁰⁸ Sasol 'restated' its methane emissions in 2013 following a "comprehensive data review" at Secunda, reducing them from around 400 to 120 kt/y [SDR 2013: 46]. An earlier restatement, in 2009, increased methane emissions from around 200 to 400 kt/y following "more accurate measurement" at Secunda [SDR 2009: 57]. One wonders if there are more restatements to come.



consumption, “total [greenhouse gas] emissions of the GTL system may vary between 12% less and 11% more than the refinery system, depending on assumptions about the nature of the operating conditions”.¹⁰⁹ This is scarcely the gateway to ‘low carbon development’.

For CTL, Sasol proclaimed ‘clean coal’: carbon capture and storage (CCS) combined with a choice of integrated gasification combined cycle (IGCC) or gas to power the plant itself. CCS and coal-fired IGCC were not proven technologies in 2006 and are still not proven in 2017. Be that as it may, Sasol compared three variations of CTL plants – coal-fired plants, IGCC-fired plants and gas-fired plants – with a standard refinery. It then ran the comparison again using CCS with each type of CTL plant. In Table 12, the numbers are relative to a refinery set at 1.0.¹¹⁰

Table 12: CTL CO₂e emissions compared with a conventional refinery = 1.0

CTL	Coal-fired	IGCC-fired	Gas – fired
Without CCS	2.5	1.5	2.0
With CCS	1.5	0.8	1.0

The results showed that a conventional CTL emits 2.5 times as much CO₂e as a conventional refinery but the credibility of this claim seemed doubtful: In 2004, Sasol’s Secunda plant emitted 52 million tonnes of CO₂ while the larger Sapref refinery emitted one million tonnes. With CCS, it claims that CO₂e emissions drop to 1.5 times those from a refinery. The combination of IGCC and CCS yields the lowest greenhouse gas emissions, a little below the level of a conventional refinery.

In short, on Sasol’s own information, replacing conventional oil with GTL or CTL, however modified, presents no climate change advantage over the conventional oil system that got us into the climate crisis in the first place. These results should also give pause to those who have advocated, however reluctantly, CCS as a last-ditch solution. Even assuming the carbon stays where it is put, CCS does not necessarily reduce greenhouse gas emissions

¹⁰⁹ Sasol Sustainable Development Report (SDR) 2006: 21.

¹¹⁰ Sasol presents the information in a bar chart. These numbers are the best reading we can make of it.



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to anywhere near zero. Nevertheless, South Africa's 'nationally determined contribution' to the Paris agreement suggests 'international support' to the tune of US\$450 million (about R6.3 billion) for burying 23 Mt CO₂ a year from the CTL plant. That would leave, and possibly be used to justify, about 40 Mt CO₂ a year emitted to the atmosphere. As noted in the 2015 groundWork Report, this proposes a massive subsidy, entirely to the benefit of Sasol, for a false solution.

In 2016, Sasol said that it was "voluntarily taking part in the trial phase of the South African carbon budget process" and had a limit of 301.7 Mt CO₂e for the next five years.¹¹¹ That is 60 Mt CO₂e emissions a year in South Africa compared with Sasol's global emissions of 69 Mt in 2016, down from 72 Mt in 2014 with the reduction entirely due to reduced production.

More broadly, Sasol has recently developed the argument that South Africa's big carbon reductions must be made by the power sector. It has led the Energy Intensive Users' Group response to government's IRP, criticising the inclusion of new nuclear and coal largely on cost grounds, and endorsing the CSIR's 'least cost' scenario centred on renewables with a supplement of either storage or gas to balance the grid. Sasol, naturally, goes for gas and aims "to grow low carbon power generation in Southern Africa" starting with a gas-fired plant in Mozambique. [99]. As successive groundWork Reports have observed, gas is low carbon only by comparison with coal and then only if there are no leaks from well to turbine.

The Secunda plant, meanwhile, remains the world's largest single point source of greenhouse gas emissions. It is a monument to the irreconcilable contradiction of Sasol's response to climate change: "Sasol's efforts to reduce GHG emissions are aimed at addressing the climate change challenge, even as we seek to grow our portfolio of hydrocarbon monetisation options."¹¹²

111 SDR 2016: 13.

112 AR 2016: 50.



Metals

The two big polluters above are joined by a complex of metal working industries focused on Witbank and Middelburg. Once consolidated into a complex of linked iron and steel, ferroalloys and vanadium plants, these have now been sold off to a bewildering parade of investors. Their corporate histories illustrate the dynamics that have left the Highveld polluted, and workers stranded without jobs.

Anglo rules

Witbank and Middelburg were made centres of steel and ferrometals production in the 1960s. In Witbank, the US based Minerals Engineering corporation constructed a plant to produce vanadium pentoxide for export in 1957. Vanadium commanded a high price but production was expensive because of the difficulty of extracting vanadium from the ore and the market was limited. Two years later, Minerals Engineering persuaded Anglo American to buy a two thirds stake in the plant. Anglo was then left with the problem of how to make money from it and the solution that it arrived at was to build Highveld Steel and Vanadium. Construction started in 1965 and the plant was completed in 1968. Vanadium then became a by-product of steel making and the original plant became the Vantra division of Highveld Steel. At the same time, Anglo also developed Transalloys to smelt silica or manganese according to market demand.

The ore for Minerals Engineering was extracted from the Mapochs Mine, which then became integral to Highveld Steel with a dedicated railway line to carry the ore. Mapochs yields a titaniferous magnetite ore which is rich in iron but difficult to smelt because it is also rich in titanium. The process used by Minerals Engineering left the iron as waste and Anglo bet on being able to use it. Anglo and Elektrokemisk, a Norwegian company, developed a new process and Highveld was designed accordingly. It starts in the iron plants with the pre-reduction of the ore in kilns followed by smelting in submerged electric arc furnaces from which waste slag is dumped. The molten charge is then taken to the steel plant where shaking ladles are used to separate out



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vanadium slag from which vanadium pentoxide is recovered. The hot iron is fed to a basic oxygen furnace to produce steel and a waste slag that is dumped. The steel then goes to a structural steel mill or a flat products mill where it is reheated in kilns and rolled into products.

Anglo entered into the business because, in the late 1950s, “the capital requirements of the Orange Free State goldfields [were] met” and “further investment [in gold] was not justified by the market conditions” [Cross 1994: 83]. Anglo was therefore looking for other profitable investments and started diversifying into industry. For the most part, it simply bought control of other companies, as with Minerals Engineering, but Highveld Steel was a massive new undertaking that entailed considerable risk.

Iscor rivalry

By the early 1960s, Anglo was already doing deals with emerging Afrikaans finance houses – Sanlam and Rembrandt – that enabled the creation of Gencor, as told in Part 1 [40], and was intended to erode “the hostile divide between Afrikaner and English capital” [Fine & Rustonjee 1995: 111]. Anglo also wanted to bring in iron making skills and so offered Iscor a partnership in the project and even offered it control of the board. Iscor rejected the offer, in part because it “had launched its own expansion plans which were designed to supply the whole South African market” in pursuit of government’s policy objective of supplying cheap steel to industry [Cross 1995: 86]. But the central reason, as economic historian Tim Cross tells it, was that Iscor’s Afrikaans managers, who had recently displaced the erstwhile English leadership of the corporation, saw Anglo as a threat both to Iscor’s control of the steel industry and to “the cause of Afrikaner nationalism”. Far from wanting a partnership with Anglo, they wanted government to “clip the wings of Anglo American” [86, 91]. Government, however, preferred to support Sanlam’s position. It also wanted to expand steel making to supply the arms industry that it was then bringing into being.

Anglo then decided to make the investment on its own. This followed the discovery, in 1964, that vanadium had more industrial uses than previously



thought, which created a big step up in demand. The corporation looked elsewhere for experience of steel making and bought Scaw Metals for the purpose. Iscor now had to deal with Highveld on avoiding “duplication of production facilities” [87] – that is, avoiding direct competition by agreeing what each would produce. At the same time, Iscor set up an investment company to take control of downstream companies that used steel. In part, Iscor feared that these companies might prefer to buy from Anglo – which already had shares in several of them. In part, it was still looking for ways of challenging Anglo’s economic primacy.

This only ended in further compromise. In 1967, the British Labour government nationalised the steel industry, creating the British Steel Corporation (BSC) which inherited control of key downstream companies in South Africa – Baldwins, Steward & Lloyds and Dorman Long. Iscor saw Labour as a hostile government and wanted South African control of these companies. Since Anglo was also a significant shareholder in these companies, Iscor had to negotiate with two ideological devils. The three parties eventually created International Pipe and Steel Investments South Africa (Ipsa), with Iscor holding 50%, BSC 35% and Anglo 15%, an uneasy alliance “through which the South African steel and engineering industry was controlled for roughly the next ten years” [Cross 1994: 94]. Fine and Rustomjee observe that this coincided with the integration of Afrikaner with English capital in the 1970s.

Concentrating control

In Witbank, meanwhile, the heavy metal industries were increasingly integrated under Highveld’s banner. Anglo, parent to both companies, handed control of Transalloys to Highveld in 1976. Two years later, Highveld took control of the Rand Carbide ferrosilicon smelter, Witbank’s first large metal plant established in 1926 close to the town centre. As with Anglo’s acquisition of Scaw Metals, Highveld was as much interested in Carbide’s expertise and experience as in the plant itself. By the 1980s then, Highveld dominated industrial Witbank with the main steelworks, Vantra (later Vanchem), Transalloys and Rand Carbide managed more or less as a unified system. Von Holdt [2003] shows



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that it expanded production, products and profits through to the 1990s and employment at the four plants peaked at over 7 600 before management slashed jobs in a productivity drive in 1997.

Ferrometals was then the only big Witbank plant outside Highveld and Anglo control. It was acquired by the African Metals Corporation (Amcor) in 1959, at which time it had two smallish ferrosilicon smelters. It expanded rapidly and continuously in the next decades, dropping silicon along the way, to become one of the largest ferrochrome plants in the world, operating six furnaces. The massive F4 and F5 furnaces, built in the 1970s, dominate the site. The Ferroveld plant, which makes electrode paste used in smelters, was built alongside the smelters in a joint venture with Highveld Steel. Amcor merged with SA Manganese in 1975 to form Samancor. The merger combined ferrochrome at Witbank with manganese production at Meyerton in the Vaal Triangle. Gencor acquired a majority interest and took control in 1983. It brought the Tubatse Ferrochrome smelter in the Steelpoort valley into the firm. Thus, the links between Anglo and Gencor in mining were reproduced in the Witbank metals industry.

As in Witbank, the big smelters in Middelburg were built in the early 1960s. The ferrochrome plant was in production by 1964 and the steel plant started producing in 1966. Just as Highveld Steel created a unified production system across several plants, Rand Mines & Bulloch (RMB) established the two plants together under the name Middelburg Steel and Alloys. In this case, the intention was that the chrome plant would provide inputs for making stainless steel.

The management was divided in 1991 and the chrome plant sold to Samancor under the name Middelburg Ferrochrome. At the same time, Highveld Steel, Samancor and the IDC formed a joint venture to take over the steel plant. In a curious nod to the imperial roots of modern capitalism, they rebranded it Columbus Steel to mark the 500th anniversary of Columbus landing in the Americas.

When Gencor disappeared into Billiton, as told in Part 1 of this report, the latter inherited its shares in Samancor. In 1998, Billiton formed a joint venture with Anglo to buy out the minority shareholders and delist Samancor. Billiton



(later BHP Billiton) retained control with a 60% stake. Anglo, with 40%, now had a major stake in Ferrometals in Witbank and Ferrochrome in Middelburg alongside its ownership of Highveld and its subsidiaries. Thus, it either owned or had a major interest in all the big metal plants in Witbank and Middelburg. This was, however, the high water mark of Anglo's dominance.

Iscor privatised

Iscor, meanwhile, was having a bad transition. In 1995, it embarked on a joint project with the IDC to build a new steel mill at Saldanha Bay with cutting edge technology aimed at producing for export. It started producing in 1998 but the timing was exactly wrong. Large steel surpluses came onto the market as the result of the IMF induced 'Asian crisis' and new production in China, South Korea and Brazil added to the surplus. The international price of steel collapsed and domestic demand did not compensate.

Iscor and IDC each held 50% of the shares in Saldanha Steel. By 2000, the venture was bleeding cash from both corporations. It accounted for 65% of the IDC's portfolio and threatened its very existence. In panic, the IDC came up with two strategies. First, it drove a process of 'unbundling' Iscor by splitting off its iron ore and coal mining operations to form Kumba Resources. Next, IDC looked for an international investor to bail it out. It found Lakshmi Mittal, a tycoon with a reputation for buying up unprofitable state-owned steel producers with low cost production bases, like Iscor, and turning them around through cutting labour and product lines and upgrading technology. His atrocious environmental record did not register as an issue with the IDC.

A fire sale doesn't quite describe it. They paid Mittal to take it away and he built up his shareholding to take majority control in 2004. The unions contested the takeover. Iscor had reduced its workforce from 44 000 in 1980 to 12 200 in 2004 and unions rightly anticipated that Mittal would cut more jobs. Investors, in contrast, lauded the high profits managed by Mittal. Two years later, Mittal managed a takeover of Arcelor, Europe's largest steelmaker, to create the biggest steel producer in the world.



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ArcelorMittal leached money from the South African economy. The Department of Trade and Industry (DTI) had facilitated the Iscor takeover on the understanding that the benefit of dirt-cheap ore would be passed through to domestic steel users and so create a competitive advantage to local manufacturing. It did not, however, bring in measures to enforce this gentlemen's agreement. Being the dominant producer, ArcelorMittal instituted import-parity pricing, meaning that it loaded the price with the imaginary costs of transport to South Africa, handling costs at the ports, a 5% import duty, and transport inland. This added around 30% to the price of domestic steel and, between 2002 and 2005, Mittal charged domestic customers over 60% more than it charged for export steel [Roberts and Rustonjee 2009]. As its last option to reduce steel prices, the DTI then scrapped the import duty.

Dis-integration

In 1999, Anglo listed on the London stock exchange and was then confronted by the shareholder value movement which demanded first, that companies should focus on their 'core' business and second, that everything else should be sold to 'return value' to investors. Anglo, which periodically pleaded for 'patient capital' and complained that it was undervalued by the market, did not fare well in the impatient environment of financialised capital.¹¹³

In 2002, Anglo, Samancor and IDC sold a controlling share of Columbus to Spanish transnational steelmaker Acerinox.

In 2005, BHP Billiton and Anglo sold the Samancor chrome business to Kermas, a Russian transnational corporation. Kermas claims it "transformed [Samancor] and vastly improved its profitability, before selling its interest in November 2009". It sold to Terris Chrome, a company registered in the offshore jurisdiction of Mauritius and about which nothing more is known.

In 2005, Anglo announced its intention to sell Highveld. In 2007, it hired Cynthia Carroll, a US business person, to bring it into the globalised age. She promptly concluded the sale of Highveld to Evraz, a Russian steelmaker owned by oligarch Roman Abramovich, stating that this was "an important

¹¹³ On the side of investors, see John Gapper, *Anglo failed to make the leap to global markets*, Business day, 22 February 2016.



milestone in implementing our strategy of refocusing Anglo American on its core mining business”.¹¹⁴ European and South African competition regulators, however, refused to permit the deal unless Evraz undertook to dispose of all the Highveld subsidiaries including, and particularly, the vanadium assets. They held that Evraz would otherwise establish a position of dominance in the vanadium market.

The effect was that everything went offshore. In July 2007, Transalloys was sold to Mineral Mining Consulting, a subsidiary of Renova, a private investment group belonging to Russian oligarch Viktor Vekselberg. Mineral Mining Consulting is registered in Cyprus which played the role of a tax haven, notably for Russian wealth of obscured origin.¹¹⁵

In October 2007, Rand Carbide was sold to Silicon Smelters, a subsidiary of a private Spanish transnational Ferroatlantica which, since 2015, has apparently been controlled through London-based Ferroatlantica International which, in turn, is controlled by Ferroglobe Plc, also in London. The City of London is a global centre of capital but, as Urry observes, has not only made itself into an ‘offshore island’ but is at the centre of a web of wealth havens [2014: 59].

In April 2008, the vanadium assets were sold to Vanchem Vanadium Products, a special purpose company controlled by Duferco Investment Partners, headquartered in Luxembourg and with a global network of 111 registered companies. Duferco was set up in 1979 “to exploit the advantages of ‘emerging markets’ in steel production”. In the 1990s, it also acquired distressed European steel mills at knockdown prices. It has also established itself as a steel trader with its own shipping and logistics business.¹¹⁶ It last produced an annual report in 2014 when it was bought out by Chinese steelmaker Hebei.

The forced sale of Vanchem broke the original rationale for the creation of Highveld Steel and Vanadium – that the characteristics of the ore from Mapochs dictated the combined production of steel and vanadium. Hence, the sale was accompanied by guarantees that Vanchem would retain access, “at market

114 Mariaan Webb, *Anglo sells Highveld stake to Evraz*, Engineering News, 7 May 2007.

115 In 2012, Cyprus was engulfed in a banking crisis that had its origins in the meltdown on Wall Street and the European debt crisis. In response to a punitive European response, the Russian government bailed out Cyprus but Cypriot banks and those who deposited money in them lost heavily.

116 See Duferco’s website at <http://www.duferco.com>.



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prices”, to ‘fines ore’, brought to Highveld Steel by the ore train from Mapochs, and to vanadium slag produced at Highveld as a by-product of steel making.¹¹⁷ Most of Highveld’s vanadium slag, however, was sold to Hochvanadium, an Austrian company owned by Highveld. Investigations by the South African Revenue Service (SARS) subsequently revealed that this was a shell company, which simply outsourced vanadium manufacture, established to transfer income from South Africa to Austria where it could claim tax concessions.¹¹⁸ The sale to Vanchem did not include Vanchem’s massive waste dump opposite the plant. Hence, this remained as Highveld’s liability.

The reference to market prices no doubt reflects the faith of competition regulators in the natural order of markets. The South African regulators have gained credibility by exposing price fixing and collusion in just about every economic sector in South Africa. In the steel sector, the Competition Commission found that producers had formed cartels to fix the prices of scrap metal, long steel products and flat steel products. Highveld and ArcelorMittal formed the flat steel cartel.

Competition regulators are, nevertheless, key institutions of neoliberal capitalism, at once expressing the faith in self-regulating markets while simultaneously demonstrating that competition must be enforced. The enforcement, of course, is no more free of vested interest than are markets themselves. Amongst other things, competition regulators are enforcing secrecy around issues such as pricing, sales volumes and industrial processes. And the corporates, who have long concealed their actions behind ‘commercial confidentiality’, are using competition to justify secrecy relating to emissions and particularly to greenhouse gas emissions. The effect, in our view, is not that rival firms are denied information – they come by it one way or another – but that the public is denied information. Except in limited processes, such as bidding for tenders, we think a requirement for open information enabling public scrutiny would provide better protection against corporate rip offs.

117 Evraz Press release, *Highveld Agrees on Disposal of Certain Vanadium Assets*, 22 April 2008; Mariaan Webb, *Duferco unit to buy Highveld’s vanadium assets for \$160 m*, 22 April 2008.

118 Dewald van Rensburg, *How Evraz ‘dodged’ R685 m in taxes*, City Press, 21 February 2016.



As we observed in Part 1 [185], ‘offshore’ is another key institution of neoliberal capitalism, albeit denied. It provides a space of obsessive secrecy beyond scrutiny or regulation that facilitates the global accumulation of capital. It is often not just about single offshore locations, such as Mauritius or Doha, where corporate secrecy is guaranteed, but about complex corporate webs designed for evasion across multiple offshore locations. A large part of international trade is between the subsidiaries of transnational corporations who can conceal the transfer of wealth from one location to another through such practices as transfer pricing. The breakup of Highveld suggests a symbiotic relationship between the competition regulators, as the priests of market rectitude, with the unregulated primal nature of capital as plunder. And the underlying value of both is secrecy.

Highveld bust

Commodities boomed, with prices hitting extraordinary highs in the first three quarters of 2008 – largely because investors were then in flight from other assets such as bonds and shares and, desperate to find a safe haven for capital, crowded into commodities. Following the meltdown on Wall Street, however, commodities crashed along with everything else. Highveld Steel doubled its profits on the price spike and paid windfall dividends to new owners Evraz. In 2009, profits crashed by over 90% but Highveld was still in profit. This was achieved by cutting costs on maintenance. But that, according to its annual reports, was the last time it did make a profit. The maintenance costs came due in 2010 and were compounded by rising input costs, notably for electricity.¹¹⁹ The annual reports, of course, did not mention profit shifting to Hochvanadium.

At the end of 2012, Evraz was thinking of selling and, in March 2013, announced “the proposed sale” of its stake in Highveld “to Nemascore (Pty) Ltd, black economic empowerment consortium, [sic] for ... US\$320 million”.¹²⁰ The deal raised suspicions for three reasons: first, the offer was more than

¹¹⁹ Highveld Annual Report 2010: 63 on deferred maintenance. See the 2008 AR for the boom results. 2013 appears to be the last annual report produced.

¹²⁰ Evraz press release: *Evraz announces intention to sell its South African steel mill*, 27 March 2013.



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double Highveld's market value – despite debt, major environmental liabilities and the fact that the Mapochs life-of-mine was down to 10 years; second, Nemascore was registered just one month earlier and, obviously, had no track record in steel making and no money; and third, it soon became apparent that Nemascore was closely linked to Zuma.

Moscow based journalist, John Helmer, suggested that the deal depended on VTB, Russia's state bank, lending the capital to Nemascore. The bank also held Evraz debt and would be able to conceal anomalies in repayments. In short, the premium paid for Highveld might benefit Nemascore as well as Evraz. The deal also appeared to depend on a second deal that would also be financed by VTB. The Highveld deal was announced while the Brics summit was on in Durban, leading to speculation that it was linked with the nuclear deal then being negotiated between Zuma and Russian President Vladimir Putin. However, Nemascore did not get the loan and, in February 2014, Evraz acknowledged that the deal had fallen through. In Helmer's view, this was because the nuclear deal no longer looked like a certainty.¹²¹

A year later, in April 2015, Highveld said it was broke and entered business rescue. Most of its creditors were suppliers and service providers, that is, firms that did business with Highveld. There were two additional liabilities. The first concerned the cost of environmental compliance and cleaning up Highveld's environmental legacies – notably the Vanchem waste dump. The second was SARS calculation of taxes and penalties, amounting to R685 million, against earnings of R2.2 billion transferred to Hochvanadium between 2007 and 2012.

The business rescue practitioners planned to sell Highveld with the Mapochs mine as a going concern. This was opposed by Evraz who wanted to scrap everything. In September 2015, an offer was accepted from International Resource Ltd (IRL), a Hong Kong based company with interests in both steel

121 Jana Marais, *Highveld's R2.8bn heist*, Business Day, 16 April 2013; John Helmer, *Evraz deal to sell Highveld steel misses deadline, as South African government blows VTB financing away*, Business Insider, 3 July 2013; Lionel Faull, *Intrigue of trillion rand nuclear prize*, Mail & Guardian, 7 March 2014; John Helmer, *No Rosatom reactor sale to South Africa, no Evraz sale of Highveld Steel, no coincidence*, posted at JohnHelmer.net, 27 February 2014; Bloomberg, *Evraz Highveld Steel: Russian owner brings in local partner*, Business Report, 14 August 2014.



and vanadium, to buy out Highveld's debts for R500 million.¹²² Five months later, the deal fell through and the plant was closed on the 10th of February 2016. Vanchem was put into business rescue in November 2015 and closed on the 26th of January 2016, two weeks before Highveld. The workers believe this plant would be profitable but it had no ore supply without Highveld.

Highveld was generally portrayed – not least by Evraz itself – as a victim of the crash in commodity prices. In particular, it could not compete with cheap steel which China was dumping on the South African market – that is, selling at below the cost of production to keep its own steel mills rolling. Workers note that the structural steel for building Kusile, 40 km from Highveld, was imported from China. They argue that government could and should have required that the steel come from Highveld. But government policies did not show a commitment to workers or jobs.

Workers also believe that Evraz had no real commitment to the plant or the local community. Solidarity's Gideon du Plessis takes that a step further: "Evraz milked Highveld and then sank it" to benefit its international position in the vanadium market.¹²³ And they brought an authoritarian approach to managing the plant that alienated even the local management and undermined productivity.

He argued further that there were two political agendas in play. The Department of Labour first promised, and then failed to deliver, a skills retraining programme including stipends for workers. This was to punish Numsa for its opposition to the ANC. The second was that ArcelorMittal would be able to take over Highveld's share of the South African steel market and it would also take Highveld's structural steel mill as it did not have one. This would benefit Likamva Resources, ArcelorMittal's BEE partner, which had links with Zuma.

Finally, says Du Plessis, it was the Green Scorpions that sank the deal, as IRL would have had to pay close to R1 billion to comply with environmental laws.

122 Business Rescue Plan: Evraz Highveld Steel and Vanadium Limited, prepared by Daniel Terblanche and Piers Michael Marsden, 15 September 2015. The sale amount was R350 million plus R150 million for an IDC loan given after the company entered business rescue.

123 Chris Barron, *'Evraz milked Highveld Steel, then sank it'*, Sunday Times, 3 April 2016; Gideon du Plessis: *Highveld Steel – an anti-SA agenda – tale of tragedy, treason*, BizNews.com, 14 March 2016.



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This echoed, but put a conspiratorial twist on, the views of the business rescue practitioners: “I certainly don’t want to blame environmental authorities – but that was the big one. There are some legacy environmental issues that require urgent attention”. He added that there were other factors, such as the slowdown in China, that probably also influenced IRL’s decision.¹²⁴ The DEA felt compelled to put out a press release arguing that it had not placed an unreasonable burden on Highveld Steel:¹²⁵

The Department places on record that it has been extremely reasonable over the years in relation to working with Highveld Steel to come into compliance with environmental legislation and permits.

Since 2007, inspections have been conducted at the facility in Mpumalanga and it has issued various notices to compel Highveld to take action to address the ongoing contraventions that impacted both the environment and human health. To date, none of these notices instructed the closure of the facility, as it has always been important to balance the environmental, social and economic issues.

The DEA said it would rather the facility remain open and profitable so it could address the environmental issues and that it had been “eagerly awaiting” IRL’s proposals for addressing them. Finally, it had never fined Highveld and, although a “criminal investigation has been finalised”, prosecution “has not yet commenced”. In short, the DEA treated Highveld with kid gloves.

The criminal investigation was in fact finalised three years earlier in 2013.¹²⁶ Contraventions of environmental authorisations dated back at least to 2007. Amongst other things, it had unauthorised waste dumps, used ineffective gas cleaning equipment and polluted the air from many points all along the production line, notably from the iron plants where “regular breakdowns ... resulted in uncontrolled emissions to the atmosphere” [Hugo 2014: 59]. In the view of Highveld workers, management chose not to reduce pollution. “Around

124 Mark Allix, *Stricken Evraz Highveld’s sale tanks*, 8 February 2016.

125 DEA press release, Department of Environmental Affairs not to blame for Evraz Highveld Steel closure, 21 February 2016.

126 DEA, National Environmental Compliance & Enforcement Report 2012/13: 39.



2006 or 2007, they decided it was too expensive and decided to dodge law enforcement. Eventually, they had to pay penalties. That's part of the reason we are sitting outside."¹²⁷

In an interview for this groundWork Report, DEA officials said Highveld was looking for concessions and the DEA had resisted pressure, from within government, to relax compliance.¹²⁸ In this context, the DEA was responding to a different set of concerns. Community groups have long argued that new smoke stack industries cannot be allowed in priority areas where ambient standards are already exceeded. The DEA's response is that they want clean new industries to replace dirty old industries. "If we say no new industry, we are condemning South Africa to being stuck with dirty old industry." Highveld, they said, had closed because of market conditions but environmental liabilities are part of business decisions. It is a case of a dirty old industry closing.

This theme has been playing for decades. In the 1990s, various worthies from the World Bank to Treasury, who were then defending Gear and South Africa's incorporation within the globalising world market, argued to the effect that "foreign investments would usher in new skills and clean and green technologies to replace South Africa's dirty old industrial plant" [Hallowes 2002: 4]. Part of the problem is that the pairing of 'clean and new' for projects based on fossil fuels is invariably dubious. In some cases, environmental authorisations have been handed out to projects which are cleaner than older industries but do still pollute. Put two of them together and the overall impact will be little different. In other cases, new projects look as dirty as old industry and represent lock-in to another 40 years of pollution. A second concern is that the DEA's approach avoids accounting for cumulative impacts – which was the point of declaring priority areas. This applies both to new projects and to assessments of existing plants. Hence, as Cairncross observes, Eskom's Kriel and Matla power stations are next door to each other but the atmospheric impact assessments for each ignores the pollution from the other.¹²⁹

127 Interview 7 March 2017.

128 Interview DEA, Vumile Senene and Patience Gwaze, 6 June 2017.

129 Eugene Cairncross, interview 18 July 2017



Box 11: Not so clean coal power

Following the success of the REIPPPP, the DoE's IPP office demonstrated its priority for privatisation ahead of climate or environment by using the same methodology for a coal baseload IPP programme (BLIPP). Fourteen projects have been proposed, most of them in the range of 300 to 1 200 MW, and most taking the cheap option for fluidised bed combustion (FBC) boilers. All are claimed to be needed to relieve the power shortage that was already relieved two years ago. They will take around five years to build so any that start construction now will be seven years too late to save the day.

Thus far, the DoE has held one BLIPP bidding round and only two projects made it through that round: Thabametsi near Lephalale and Khanyisa in eMalahleni. Both have been given environmental authorisations (EAs), despite the uneven quality of the environmental impact assessments (EIAs), but have been challenged at various points by Earthlife Africa, groundWork, the Highveld Environmental Justice Network (HEJN) and the Centre for Environmental Rights (CER).

Earthlife appealed the Thabametsi EA because, amongst other things, climate change was not properly addressed in the EIA. The minister admitted this point and told the project proponent to do a full climate change impact assessment. However, she did not set aside the EA pending the outcome of that assessment but said the assessment must be done as a condition of the EA. Earthlife took this to court on the grounds that the assessment must inform the decision to grant an EA. The court agreed and set aside the Minister's appeal decision, ordering her to reconsider Earthlife's appeal but this time with Thabametsi's climate change impact assessment. The proponents have now submitted a climate change impact assessment and the DEA must make a new decision that is informed by it.

Khanyisa is meanwhile applying to Nersa for a licence to generate electricity. groundWork is opposing that and, following the Thabametsi decision, has instituted review proceedings in the courts to set aside Khanyisa's EA which the DEA granted with scant regard for climate impacts. The original EA was granted for a 450 MW plant and has subsequently been amended for a



600 MW plant, without much evident scrutiny of what difference 150 MW makes, and did not consider greenhouse gases other than carbon dioxide.

It is difficult to see how these plants fit into any conception of clean new industry replacing dirty old industry. The FBCs are inefficient and their greenhouse gas emissions are comparable with Eskom's oldest power stations. Khanyisa proposes pollution controls for local emissions from the smokestacks of SO₂, NO_x and particulates: the addition of lime to the furnace for SO₂; a Selective Non-Catalytic Reduction for NO_x; and a fabric filter baghouse for particulates. Given South Africa's corporate culture, it is not unreasonable to think that these costs may be avoided periodically over the 50 year lifetime of the power station. Other pollutants, including carbon monoxide, metals, various VOCs including benzene, dioxins and furans, are not mitigated. In addition, coal and ash handling will result in windblown toxic dust. It appears that Khanyisa plans to reduce that by 75% rather than the 95-99% possible "with properly engineered controls and effective work practices".¹³⁰

Khanyisa is planned for just south of eMalahleni, the hottest of air pollution hot spots within the Highveld Priority Area. The site is surrounded by coal mines and Duvha is 10 km away. Unlike Duvha, it will not have a 300 m tall stack and will not sit high on a hill. It is close to residential areas – including Tasbet Park where the Highveld Steel workers went to escape the worst of Highveld's pollution – and just 2 km from a primary school. It is unlikely that Khanyisa will not contribute to exceedances of ambient standards in the area.

Khanyisa's ash dump will almost certainly add to the pollution of the Olifants River. Lisa Evans, an expert on ash dumps at Earthjustice, an environmental justice organisation in the US, observes that plans for handling and disposing the ash "have not kept pace" with the plans to expand the plant from 450 MW to 600 MW.¹³¹ Besides, the dump site was already too small for the

130 Ranajit Sahu, *Report on the Air Quality Impacts of the Proposed Khanyisa Power Station*, 23 February 2017: p.5.

131 Lisa Evans, Environmental risks posed by coal ash disposal at the proposed 600 MW Khanyisa Power Station, 23 February 2017.



massive quantities of ash that must effectively be stored forever. Various technical analysis and design elements relating to the lining and leachate management are either not available, inadequate or just wrong.

An underlying concern relating to both air and water is that there are serious gaps in the environmental impact assessment which the DEA either did not pick up or ignored when it issued the EA. Even if we were to believe the fairy tale of 'clean coal', there seems little reason to think that tough regulation from the DEA will deliver it.

Saving steel?

As Highveld Steel was going into business rescue, ArcelorMittal also found that the tables had turned. In place of the 30% premium garnered through import parity pricing on local steel sales, imported steel was now 12% cheaper than ArcelorMittal's cost of production. In July 2015, CEO Paul O'Flaherty admitted that the corporation had been a "poor citizen" but nevertheless asked government for protection from cheap Chinese imports in return for a 'fair pricing model' for steel. Otherwise it might have to close the Vereeniging plant which employs 1 200 people including contract labour.

Shortly thereafter, Numsa convened a meeting of unions and employers to save the steel industry. Numsa said there was a risk that the industry would collapse. A joint delegation to government repeated ArcelorMittal's request for support, warning that 190 000 jobs were at stake in the industry with 100 000 more in the supply industries. Agreeing to the demand, Trade and Industry minister Rob Davies nevertheless recalled the corporation's poor citizenship.¹³²

The joint business and labour delegation to government added several points to O'Flaherty's offer. They called for: 10% tariff protection and anti-dumping measures; a "fair pricing model"; government procurement of local steel for

¹³² Rob Davies, *Steel is a key strategic industry for South Africa's growth*, The Mercury, 31 August 2015. See also Terence Creamer, *'Poor citizen' AMSA promises to mend ways as it seeks support to save Vereeniging and company*, Engineering News, 23 July 2015 and *'Fair' steel pricing model will cap good-times upside, offer bad-times collar*, Engineering News, 31 July 2015; Tshepo Tsheole, *Numsa fights to save steel sector's looming massive job cuts*, SABC, 24 August 2015.



public infrastructure projects; a ban on scrap metal exports; government support for “training lay off schemes” – training instead of retrenchment – that were soon to fail the workers at Highveld; and “delaying” implementation of the carbon tax.¹³³ Immediately following the joint delegation’s meeting with government, ArcelorMittal announced that it would cut 400 jobs at the Vereeniging plant. Numsa vowed to fight all retrenchments but, in December 2015, the corporation closed the Vereeniging melt shop with the loss of 285 jobs. The DTI has meanwhile implemented the 10% tariff protection for products produced by ArcelorMittal and topped this with another 12% ‘safeguard’ duty on hot rolled coil. While the DTI is determined that South Africa should not lose its steel making industry, it also wants a ‘developmental’ price of steel to support manufacturing in the future. ArcelorMittal says that, in terms of its ‘fair price’ method agreed with government, the tariff and safeguard protections will not influence the price to manufacturers. The latter, however, observe steep increases and say the method favours ArcelorMittal at their expense.¹³⁴

Back at Highveld, meanwhile, the structural steel mill has been reopened in terms of a ‘contract manufacturing agreement’ with ArcelorMittal. The latter will supply steel blooms – large chunks of steel – for processing into structural steel products which are then returned to ArcelorMittal for marketing. The blooms are produced at ArcelorMittal’s Newcastle plant which, the company says, is also struggling. Both corporations are still looking for more protection. There are now 500 people employed at Highveld – in the mill and at a business park at the site.¹³⁵

Ferroalloys

The steel and mineral smelters are very intensive electricity users. In 2009, the Department of Energy (DoE) failed to produce an Integrated Resource

133 Joint statement by Labour and Business on government outcomes, posted at <http://www.numsa.org.za/article/category/press-releases/> on 24 August 2015.

134 Creamer Real Economy Insight: Steel, June 2017.

135 Terence Creamer, *Protection and recovery in infrastructure spend to determine fate of revived Highveld mill*, 6 June 2017.



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Plan (IRP) for electricity as it was legally obliged to do. As recounted in the 2015 groundWork Report, it then called in the minerals-energy complex A-list – Eskom, Anglo American, Billiton, Sasol, Xstrata and the Chamber of Mines – to form a ‘technical committee’ to do the job for them. The very existence of the committee was supposed to be secret. Word of it leaked out but civil society requests for minutes were refused [McDaid 2010].

The draft IRP displayed the MEC’s vision for future power. This was only slightly modified, following public comment, in a final “policy adjusted” IRP 2010 adopted by cabinet in March 2011. Its most striking feature was that it projected a rapid increase in demand for electricity for the period 2010 to 2030 and concluded that generating capacity would have to more than double from less than 40 000 MegaWatts of capacity to 89 000 MW. The primary driver of this extraordinary increase in demand came from the many new ferrochrome smelters that the DoE’s ‘technical committee’ said would be built. The plants would need big base-load power, meaning more coal and a fleet of nuclear power stations.

In 2012, Eskom was again struggling to keep the lights on despite the fact that demand had barely recovered to its 2007 pre-crash high and it had since added about 4 000 MW capacity. It therefore approached the big energy users and offered to ‘buy back’ the electricity they expected to consume. That is, Eskom would buy back what it had not yet sold and at a premium price.

The ferrochrome producers immediately volunteered as the market was oversupplied and the price of ferrochrome had crashed. Xstrata-Merafe (now Glencore-Merafe) shut seven smelter units, International Ferro Metals shut two, Tata shut two and Hernic shut one. Samancor and the Kermas Group’s Ruukki (now Afarak) shut more furnaces. In total, nearly half South Africa’s ferrochrome capacity was shut between February and June 2012. What Eskom paid for the electricity it did not sell was not disclosed but Xstrata-Merafe said it would have “a net positive economic impact” for the firm: it would shut down for a profit.

At the same time, Xstrata-Merafe called for a trade tariff on chrome ore exports. China, they said, was importing South African ore and smelting it cheaper than



the local producers, so causing a massive shut down of South African plant. That was, of course, the same plant shut down for Eskom's buy-back. And most of the firms exporting ore to China were those that shut their South African smelters. Amongst other things, the producers complained that the Chinese smelters enjoyed cheaper electricity. Since industry was and is still supplied at below the cost of production, this implied that South Africa's energy subsidy was no longer competitive with China's energy subsidy.

More broadly, the local smelters were making more ferrochrome than they could sell, driving down the price and so compounding their losses. Just as something had to break, Eskom's buy-back paid out handsomely for electricity they would not use in smelters they wanted closed. The price of ferrochrome then started to recover. In short, these transnational corporations made a profit without going to the trouble of producing goods that were not wanted using power that was not there.¹³⁶ Eskom's buy-back programme was terminated after the first quarter of 2013. The ferrochrome smelters then went back to business and most reported strong results in 2014.

Prices crashed again in 2015 through to September 2016 when they rose sharply. In that period, several plants shut down furnaces or closed altogether. Several firms went bust but others did well on the crisis as they bought out the assets of their distressed rivals.

Assmang, a partnership between Assore and African Rainbow Minerals (ARM), closed an inefficient and dirty ferrochrome smelter at Machadodorp. The plant was the major local employer with 360 people. It opened a new plant in Malaysia because, it said, the Malaysians guaranteed annual electricity price rises of just 2.5%. South Africa's electricity prices were also competitive but would become less so as Eskom's tariffs continue to rise. Assmang also closed one smelter at its Cato Ridge manganese plant near Durban and said labour would be "right-sized" – the new phrase for job cutting.

¹³⁶ The buy-backs were widely reported. See amongst others from Mining Weekly: Martin Creamer, *South African ferrochrome in meltdown, urgent intervention needed*, 16 March 2012; Martin Creamer, *New Merafe CEO backs chrome exchange proposal*, 20 June 2012; Martin Creamer, *South African ferrochrome profitability down to zero – Danko Konchar*, 6 September 2012; Reuters, *SA ferrochrome output cuts expected to boost prices*, 31 January 2013. See also Merafe Resources: *Reviewed Interim Results For the six months ended 30 June 2012*.



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Tata's ferrochrome smelter in Richards Bay, constructed with much fanfare barely a decade ago, also went bust. The liquidators managed to sell it as a going concern to Traxys, a privately held company based in Luxembourg. Traxys appears to be mostly about financial services and trade with a bit of production on the side. It is rumoured that one of the two furnaces at Richards Bay is still closed, even after the recovery of prices, as Traxys finds it more profitable to export chrome ore than to produce charge chrome.¹³⁷

South32 (formerly BHP Billiton) closed three of four manganese smelters at its Samancor Metalloys plant in Meyerton in May 2015. They were still closed in the first quarter of 2017.

Silicon Smelters shut down its plants in eMalahleni and Polokwane in June 2016. Following Eskom's price hikes, electricity is now a major cost and the company says it won't reopen any time soon unless it gets a discount.

Samancor did well on the crisis. Its established smelters were Ferrometals at eMalahleni, Ferrochrome at Middelburg and Tubatse at Steelpoort and it added two more as other firms went bust. The first was International Ferro Metals' (IFM) operation at Mooinooi in North West Province which had been put into business rescue in August 2015. IFM blamed labour militancy and power outages along with the collapse of the ferrochrome price. It employed 1 215 people. Samancor bought the plant one year later, in August 2016, for the knockdown price of R300 million and reopened it as the TC smelter. The second was ASA Metals near Burgersfort, which entered business rescue in February 2016. It too complained of wildcat strikes and declining chrome prices. The decisive issue, however, was that funding dried up following the arrest of the CEO of its Brazilian partner on corruption charges. Samancor bought the plant in April 2017.¹³⁸ Workers say there are rumours that it is also looking at the Assmang's Machadodorp smelter. In the midst of this expansion,

137 <https://intherightvein.com/2017/03/21/traxys-finds-ore-sales-more-profitable-than-producing-charge-chrome>

138 Robyn Wilkinson, *Fewer potholes on road ahead for vanadium, chrome, manganese*, Mining Weekly, 27 January 2017; Megan van Wyngaardt, *IFM completes sale of local assets to Samancor Chrome*, 23 August 2016.



however, Samancor was also retrenching workers at its existing plants and mines, claiming that they were not making profits.

The workers say Glencore-Merafe – Merafe is the BEE partner – is Samancor’s biggest competitor. It operates six smelters with associated chrome mines – Wonderkop, Rustenberg and Boshhoek in North West, the Lydenburg smelter in Mpumalanga and the two new Lion smelters at Steelpoort. The company did not buy distressed assets in the crisis but, according to Merafe, it focused on efficiency and costs. In particular, it brought the new Lion I and Lion II into production in 2014 and 2015 and claims significant cost and efficiency improvements for new technologies deployed there. In March 2017, it reported a sharp rise in earnings from increased production as some shutdown furnaces were brought back into production and the price of chrome was higher.¹³⁹

Samancor says that it is “striving for zero harm to our people and our environment”. This would come as a surprise to its neighbours. Company safety, health, environment and quality (SHEQ) policy relies largely on “developing a SHEQ culture”, process controls and application of “best practical environmental solutions”.¹⁴⁰ It does not mention climate change.

Glencore-Merafe, in contrast, acknowledges “significant” greenhouse gas emissions. Its practical response is to improve energy efficiency and, in 2016, Merafe reported reduced emissions intensity because its more efficient Lion smelters were brought into production. However, actual emissions increased because production increased.

Glencore-Merafe also plays “a leading role” in policy advocacy through the Energy Intensive Users Group (EIUG) and Business Unity South Africa (BUSA) “to ensure that the potential impact that the proposed legislation will have on our industry and Company is understood by government”.¹⁴¹ As the groundWork Report 2015 observed, the real focus of these groups is on mitigating the effect of climate policy on business rather than mitigating climate change.

139 Merafe, *Production report and trading statement for the six months ended 30 June 2017*, 14 July 2017.

140 Samancor website: www.samancorcr.com at 20 March 2017. The company says that environmental information is available to the public on request but did not respond to a request.

141 Merafe Annual Report 2016: 20.



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The MEC, however, is not what it was when it co-authored the IRP 2010 and forecast heroic growth in demand. Responding to the DoE's draft IRP 2016, the EIUG registers two major shifts. First:

South Africa's electricity demand has not grown since 2007, due largely to significant price increases, structural (not cyclical) changes in commodity markets, weak economic growth and improved energy efficiency. The lack of generation capacity was not the main reason for the drop off in demand, meaning the availability of new capacity will not automatically cause renewed demand growth.

In other words, the century of the MEC is over and it is not coming back. The DoE, now apparently advised by Eskom alone, has not woken up to this. The IRP 2016 forecast for demand growth is not as absurd as the IRP 2010, but it remains out of touch with reality. The EIUG observes that the exaggerated demand forecast produces "a high risk of overbuilding ... triggering a death spiral where excessive new capacity causes drastic price increases, leading to low or negative growth, grid defection and the stranding of existing assets".¹⁴² And overbuilding with nuclear would greatly increase that risk.

The second major shift is in the cost of renewable energy. The traditional MEC power system model was for big base load plants, like Medupi and Kusile, to supply big, power hungry industries like the smelters. This is the model that the IRP 2010 wanted to reproduce. But the cost of building the big power plants is precisely what threatens to 'trigger a death spiral'. The EIUG now appears to be letting go of base load, at least for the medium term, in favour of 'least cost'. And least cost now means renewables. That this also results in a serious reduction in carbon emissions appears as a bonus.

As noted earlier, the collapse in demand, just as its new plant started coming on line, has left Eskom with surplus power. It has already increased exports to neighbouring countries and is now looking to its traditional MEC partners to increase consumption. In February, Eskom asked Nersa to give the go-ahead

142 EIUG comment on the IRP 2016, 31 March 2017: 11 ff.



for a special pricing agreement with Silicon Smelters. Nersa has called for public comment.

At present, the discount would be offered for two years, as Eskom is reportedly reluctant to repeat the experience of BHP Billiton's (South32) aluminium smelters. In that case, it has been trapped into supplying electricity at below the cost of production for several decades. The Chamber of Mines commented that discounts would have to be substantial and long term to attract investment. ArcelorMittal has booked its place in the queue after Silicon Smelters and is now approaching Nersa for a pricing agreement. The EIUG is following that with a proposal to Nersa for 'structural changes' – in other words, permanent – to Eskom and municipal tariffs to big industry.¹⁴³

Meanwhile, Eskom is asking Nersa for a 20% price rise for the year 2018-19 so as to "migrate its tariffs towards cost reflectivity".¹⁴⁴ So this is beginning to look like 'migrating' tariffs from industry to people. Cost, of course, includes the overpriced new build, overpriced and substandard coal procured from political cronies – not only the Guptas – and consultants paid handsomely for nothing. It is unlikely that anyone will accept that this has been 'prudently' incurred as is required by law.

If Eskom has abandoned demand side management – that is, programmes aimed at reducing demand – then it seems that the DoE has followed its lead. As well as beating the drum for big base load, the IRP's demand side management is insignificant. In the midst of load shedding in 2009, groundWork predicted this moment: "As with Eskom, government's record suggests that getting a return on its infrastructure investments will trump conservation as soon as an expanded power supply is secured and irrespective of any rhetorical devotion to climate mitigation" [groundWork 2009: 20].

143 Terence Creamer, *Electricity intensive firms to approach Nersa for new job-saving tariff deal*, 16 August 2017.

144 Antoinette Slabbert, *Eskom proposes incentive pricing*, *Moneyweb*, 3 February 2017; Terence Creamer, *Eskom to make final 'double digit' tariff application for 2018/19 this month*, *Engineering news*, 5 June 2017; Terence Creamer, *Eskom tariffs in AMSA's action plan crosshairs as losses spike*, *Engineering News*, 27 July 2017.



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The various parties thus seem driven to put the MEC back together again. This is not any more likely than in the case of Humpty Dumpty. The king's horses and men are all at odds. Eskom is floundering. The big corporations that were both its major coal suppliers and major customers are no longer tethered to the country and hardly stand out from the pack of TNCs looking for quick returns and a ready exit. Small corporates, cronies and neo-colonial adventurers are pushing into their place, many of them a breath away from bankruptcy. Eskom's coal supply is fragmenting as the big old mines wind down, in part because the coal field is physically depleted, in part because the institutional relations are fragmenting. And, at the end of it, there is little reason for the rest of the country to pay tribute for the restoration of the MEC.

Future energy

In November 2016, the DoE published an Integrated Energy Plan (IEP) and an Integrated Resource Plan (IRP).¹⁴⁵ The IEP is the overall energy plan for liquid fuels (petrol, diesel, paraffin), gas and electricity. The IRP is the more detailed plan for electricity. Both plans make projections of energy or electricity demand through to 2050 and consider how to supply that demand. The IEP is composed of four different scenarios which result in different levels of demand.

The IRP 2016 does not refer to these scenarios but uses electricity demand projections developed by the CSIR. The DoE presented a 'base case' in November. This is meant as the first version in a process that ends with a 'policy adjusted' version approved and promulgated by cabinet. This final version provides the legal basis for 'ministerial determinations' on what capacity should be added to the electricity system in the following years. The new plans have been much delayed. At present, the IRP 2010 (actually approved in March 2011) provides the legal basis for decision making. The first paragraph says:

¹⁴⁵ groundWork's more detailed comment on these plans is available at: <http://www.groundwork.org.za/submissions>. The plans are available on the DoE website at www.energy.gov.za/files/IEP/2016/ and www.energy.gov.za/IRP/2016/ respectively.



1.1 The Integrated Resource Plan (IRP) is a living plan that is expected to be continuously revised and updated as necessitated by changing circumstances. At the very least, it is expected that the IRP should be revised by the Department of Energy (DoE) in 2012.

The IRP 2010 was widely criticised for exaggerating future demand. In 2013, the DoE produced a draft of the first IEP and an 'IRP 2010 update' and invited public comment. The 'update' substantially reduced forecast energy demand due to 'changed circumstances'. In consequence, it said, new nuclear power should be delayed for a decade, if not forever. groundWork welcomed that conclusion but observed that the 'update' forecast was still too high to be credible.

Following public consultations, the 2013 process disappeared. The DoE made no announcement that the process was delayed or suspended or terminated. It said nothing at all. Over the next two years, the circumstances kept on changing. Demand did not grow less rapidly than forecast. It shrank. And the cost of renewables declined faster than was expected. Meanwhile, it leaked out that President Jacob Zuma had led clandestine negotiations with Russia's President Putin for Russia to supply a fleet of nuclear power stations. This confirmed suspicions that the 2013 process was stalled because it was likely to result in the trillion Rand nuclear power build being deleted from South Africa's energy plans.

Over three years after stalling the 2013 process, the DoE presented the IEP and the IRP 'base case' at a press conference on the 22nd of November 2016. They posted the actual documents on the website on the 25th of November, along with a schedule of rushed consultations in the main centres starting just eight working days later. Some background papers on the assumptions were posted as the consultation workshops began, while a DoE paper on nuclear costs remains secret. This looked like a dishonest process designed to limit rather than facilitate participation. The DoE said this was not their intention and, following intense criticism, extended the time frame for written comments. It also held further consultations in the smaller provincial capitals but not,



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as promised, on the Highveld or other areas heavily impacted by the energy system. groundWork protested the omission but did not receive a response.¹⁴⁶

The substance of the plans was equally problematic. In particular, the IRP 'base case' inflated the known costs of renewables while depressing the costs of coal and nuclear. It also put an arbitrary limit on how much renewable energy could be added each year. Most observers concluded that the DoE had distorted the data to favour coal and nuclear. In groundWork's view, the demand forecast in both IEP and IRP 2016 was still seriously exaggerated and, as noted above, the EIUG shared that criticism.

The DoE received written comments at the end of March. It is presumed that a revised IRP 'base case' will be published later this year. However, both Tina Joemat Pettersson and Mmamoloko Kubayi, the ministers for energy before and after Zuma's March cabinet shuffle, have insisted that nuclear power will be in the plan, come what may.

Rival IRP

For the period 2020-2050, the IRP 2016 base case shows:

- 15 GW of new coal fired power following completion of Medupi and Kusile. This replaces 17 GW of existing plant due for decommissioning over the three decades.
- 20 GW of new nuclear – including the 9 500 MW proposed in IRP 2010.
- 22 GW new closed cycle gas turbines – implying a gas bonanza that is by no means assured.
- 13 GW of open cycle gas turbines. These are the 'peaking' plants that run on diesel but could be converted to gas.
- 37 GW of wind and 18 GW of solar PV.

The revised IRP base case will be compared with comment submitted by the Energy Centre of the Council for Scientific and Industrial Research (CSIR)

146 E-mail from gW to DoE: RE: IEP and IRP public consultation notices, 29 December 2016.



which effectively presents an alternative IRP.¹⁴⁷ The CSIR team used the same modelling programmes as the DoE and produced two main scenarios: ‘least cost’ and ‘decarbonised’.

‘Least cost’ is what technical energy planners argue should be the base case for any IRP process. To maintain comparability, the CSIR retained several of the DoE’s assumptions, including the future demand forecast. It also kept the DoE’s cost figures for coal, gas and nuclear but it corrected the costs of wind and solar PV to reflect actual costs bid in the most recent round of the renewables procurement programme. And it removed the DoE’s limit on how much wind and PV can be added each year.

The result is that all new capacity is renewable, supplemented by storage and gas, and no new coal or nuclear plants are built. By 2050, the main components are:

- 85 GW wind and 74 GW solar PV.
- 37 GW peaking plant.
- 19 GW closed cycle gas.
- Of Eskom’s existing fleet, only Medupi and Kusile are kept running.

Total capacity in 2050 is much larger than in the IRP base case because of the variability of renewables. Nevertheless, by 2050, this is R73 billion per year cheaper than the DoE base case, carbon emissions are at 86 million tonnes a year (Mt/y) compared with 187 Mt/y, and water consumption is 15 billion litres a year compared with 41 bl/y. Moreover, the least cost energy system employs more people: between 310 and 325 thousand compared with 252 to 295 thousand. The figures include jobs in mining coal but not jobs in manufacturing renewables.

¹⁴⁷ CSIR, *Formal comments on the Integrated Resource Plan (IRP) Update Assumptions, Base Case and Observations 2016*, by Jarrad Wright, Tobias Bischof-Niemz, Joanne Calitz, Crescent Mushwana, Robbie van Heerden and Mamahloko Senatla, 3 April 2017.

Available at https://www.csir.co.za/sites/default/files/Documents/20170331CSIR_EC_DOE.pdf

<https://www.csir.co.za/csir-energy-centre-documents>



Box 12: Fantasy in GDP

A major source of exaggeration in demand forecasts lies in the assumed rate of GDP growth. The top part of Table 13 is taken from the IEP Annexure B: Macroeconomic Assumptions. It says the figures are “based on National Treasury’s most recent in-house estimates of growth”. Since the paper is not dated, it is not clear when ‘most recent’ was. The bottom line in the table is taken from a Treasury presentation made in November 2016.

Table 13: Forecast GDP growth and actual growth (%).

	Short term				Medium term	Long term
	2014	2015	2016	2017	2018-2022	2023-2050
Low growth	1.5	1.8	2.3	2.5	2.8	3.0
Moderate growth	1.8	2.7	3.2	3.5	3.7	4.2
High growth	2.0	3.3	3.7	4.0	4.9	5.5
Actual growth	1.6	1.3	0.5			

Source: IEP Annexure B: Macroeconomic assumptions (not dated).
Actual from Treasury Investor Presentation, November 2016.

The IEP uses the moderate growth forecast in all scenarios except one – the ‘Green Shoots’ scenario is based on the National Development Plan’s (NDP) wished for growth of 5.4% till 2030. Actual growth, however, has fallen well below the ‘low growth’ forecast. As usual, Treasury sees recovery around the corner but its November forecasts for the next three years still come in below ‘low growth’: 1.3% in 2017, 2.0% in 2018 and 2.2% in 2019.

In the longer term, the low growth projection still looks optimistic. There are three major reasons for this. First, the so called ‘great recession’ is not over. Outright depression has been kept at bay only by the big central banks blowing bubbles and inflating stock prices. This will not be sustained but the costs are meanwhile pushed onto those who the global economy makes vulnerable. Second, the economic impacts of climate change and



environmental damage will increase exponentially. Third, the social costs of climate change on the one hand and of sustaining the accumulation of capital on the other will increasingly destabilise society.

The CSIR's 'decarbonised' scenario reduces CO₂ emissions as a priority. It keeps the same assumptions on demand and technology costs as 'least cost' but Eskom's power stations are retired early and Kusile is not completed. In the early years, the model adds more gas to compensate but the rest of the expansion is renewables:

- 83 GW wind and 84 GW solar PV.
- 13 GW centralised solar power. These plants store energy to operate beyond sunset but are high cost.
- 16 GW biogas.
- 29 GW peaking plant.
- 14 GW close cycle gas.

By 2050, total system costs at R675 billion/y are higher than 'least cost' but still R25 billion less than the DoE base case. Carbon emissions are down to 10 Mt/y and water use down to 10 bl/y. And employment is up to 331 thousand.

The CSIR team conclude that South Africa can "decarbonise its electricity sector without pain" as "clean and cheap are no longer trade-offs". They do this without challenging the DoE's fantastical assumptions on the costs of nuclear power. And they also refute the argument that a rapid shift to renewables will collapse the grid.

What they do not do is account for the real costs of dirty energy or for the benefits of clean electricity. Just as trashing the environment is termed an 'externality', so too the benefits of clean energy are external to the system. Taking the economic foot off the fossil fuel pedal would start a process of detoxing the world. For a start, the air would clean up fairly quickly and put thousands of people on the path to recovering their health.



Box 13: Costing nukes

Big base load projects are notoriously over time and over budget. In 2007, as noted above, Medupi and Kusile were estimated to cost R70bn and R80bn respectively but are now estimated at R195bn and R225bn – and still rising. This has fed into a five-fold escalation of tariffs. Both plants are also several years late.

The IRP 2016 now puts the ‘overnight’ costs (without interest on capital) of nuclear at R55 260 per kW.¹⁴⁸ That makes government’s 9.6GW nuclear fleet R530bn before interest. We can take this as equivalent to the 2007 estimates for Medupi and Kusile. And since nuclear will come with a big import bill and the IRP uses a dated R/\$ exchange rate of 11.55, the escalation has already started. Further, as energy analyst Chris Yelland notes, the IRP assumes a 60-year life for nuclear stations but does not include the costs of a mid-term refurbishment, end-of-life decommissioning costs or long term storage of nuclear waste.¹⁴⁹

The IRP figure is based on a secret DoE document. Yelland made his own calculations and estimated overnight costs for the 9.6GW nuclear fleet at R776bn at a R/\$ rate of 14.00. With interest, but no other cost escalation, that will go to R1 trillion and more. Yelland estimates a levelised cost of R1.30 to R1.52 per kWh.¹⁵⁰ The CSIR Energy Centre gives a lowest cost estimate of R1.17/kWh based on the lowest overnight cost estimates from Rosatom, the Russian nuclear corporation. There is no likelihood that real costs will be in line with this estimate. They are much more likely to be at or over the top of the range given by Yelland.

148 IRP 2016 Revision 1: 16.

149 Chris Yelland, Analysis: The Draft IRP2016 – lightweight, superficial and downright dangerous..., EE Publishers, 30 November 2016; Yelland crunches the numbers – Cost of electricity from new-nuclear build in SA, BizNews.com, 1 August, 2016.

150 Levelised cost is the cost of power over the life time of the plant.



Wreck or renewable

South Africa can create another energy future based on renewables or it can go down tied to the old energy model. This is the model of the 'minerals-energy complex' that has shaped South Africa's development for over a century. It is based on cheap coal, cheap labour and heavy duty pollution. It is unsustainable economically and is socially and environmentally catastrophic. It is now collapsing but, as the IEP and IRP 2016 show, the DoE is still tied to it.

The electric power system was made by building big base-load to supply 'cheap and abundant' power to energy intensive industries. Medupi and Kusile are designed for them. IRP 2010 was the creation of the combined interests of the minerals-energy complex and was confidently expected to reproduce the system. But Eskom's prices have escalated to pay for the expansion, even as the global economy – and commodity markets in particular – stutters on the edge of depression. The effective subsidy to big users, other than South32's aluminium smelters, has been eroded, the demand for power has collapsed and the big energy users themselves do not anticipate its recovery. They are nevertheless looking for a restoration of the subsidy – which is effectively a demand that the bill for Medupi and Kusile is sent to the people – and are supported by Eskom who wants expanded consumption. This *toenadering*, however, does not cover over the cracking up of the minerals-energy complex. IRP 2016 is in the same mould as IRP 2010 but now appears to be created only in the marooned interests of Eskom and those who hope to profit from the wreck.

The big new coal plants are beset by escalating costs and successive delays and the cost of funding them is exposed to rising interest rates and currency depreciation. In 2009, Eskom was already in trouble and went to the World Bank for a very large loan. Treasury then guaranteed Eskom's debt. At the time, groundWork warned that "Treasury is making a double bet: that future economic growth, and the continuous expansion of the energy system, will more than cover repayments; and that the Rand will hold its value. Otherwise, the debt becomes a trap as it did for many Southern economies in the 1980s" [groundWork 2009: 28].



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They have lost the bet and the trap is closing. Both Eskom and the government's credit rating have been downgraded. The massive import bill also contributes to pressure on the currency and becomes more significant in a period of economic fragility. The choice of a nuclear fleet beyond Kusile would compound this vulnerability and provide a short cut to national bankruptcy.

In contrast, the renewable energy projects come in on time and on budget – usually in under two years. They are, of course, smaller in scale and more easily adapted to 'changing circumstances' that prove demand forecasts fallible. Beyond the corporate projects, renewables carry another sting. For households, the costs of rooftop PV are already at or below municipal retail tariffs and will soon compete with wholesale tariffs. Local PV and other micro generation technologies may then be a) accepted as part of the national and/or municipal resource, or b) forced off-grid. If a), it may increase system (grid and storage) costs but will save on procuring generators. If b), the middle classes and commerce will go off-grid and leave municipalities and the poor with a slum grid and more poor people cut off. If big industry persuades Nersa to send the bill for Medupi and Kusile to households, b) becomes more likely. If a nuclear fleet is added, no-one will hang around to pay for it.

Over the last 30 years, transport has been made ever more dependent on liquid fuels. Rail has been neglected with the exception of the lines carrying mineral and energy resources for export – coal to Richards Bay, iron ore to Saldanha Bay and a new heavy haul line proposed for chrome ore to Coega. The capacity of pipelines to carry imported oil and refined fuels – from Durban and Maputo to Gauteng – has also been expanded. Everything else goes by road at ever increasing cost.

Throughout the 20th century – outside of war – big oil corporations had to deal with the problem that there was too much and they tried both to restrict the supply and to prod demand. The age of plenty is now over: the production of 'easy oil' is in decline and is increasingly substituted by 'non-conventional oil' – tar sands, coal-to-liquids, shale oil and gas, and ultra-deep sea oil. This has brought on 'peak poison'. The production of oil was always dirty and bloody,



particularly in the Third World, but the production of 'non-con' oil is ever dirtier and ever more expensive. And the price is ever more volatile.

Sasol's profits from coal-to-liquids were buoyed up by the high price of oil and the effect of regulated import parity pricing. When the oil price collapsed in 2014 to 2016, Sasol's bottom line was saved by the simultaneous collapse in the Rand – which meant it got more Rand for its overseas dollar earnings. But Sasol's production scarcely moderates South Africa's vulnerability to peak oil and volatile oil prices. Imported crude oil provides 70% of fuel for transport and is the country's largest import item. The IEP sees oil imports being substituted by refined fuel imports to meet escalating demand, which is apparently impervious to price rises. That supply must meet forecast demand is an assumption of energy planning from the age of plenty and will not hold in a post-peak world. The DoE evidently expects to be saved by a fantasy shale gas boom. It avoids the real challenges of the energy future.

The divorce from reality is particularly evident in respect of climate change. The IEP and IRP are plans for a world that plays the numbers but does not seriously address climate change. South Africa is currently contributing its 'fair share' towards global warming of 2°C by about 2036 – just twenty years away. Whatever coal fired stations have not been shuttered because of the sheer folly of burning more coal, will then be inoperable in the extremes of heat, drought and flood. Meanwhile, the mines that feed them are ruining the water resource.

A world that is seriously addressing climate change is a world that changes the economic and associated energy system. Energy planning should be made compatible with this world. Alternatively, it must anticipate catastrophic climate change. The IEP/IRP 2016 does neither.

In sum, if SA wants to 1) supply the energy needs of its people, 2) avoid catastrophic climate change, 3) clean up air pollution to let people breathe, 4) conserve water and prevent the further destruction of whole watersheds, and 5) avoid bankrupting itself, it is imperative to focus national resources on developing renewables under democratic control while shutting down coal plants.



4 Reinventing the future

In this chapter we set our sights on the urgent tasks required to create a future that is different from the current reckless and unreasonable trajectory of burning more coal, emitting more pollution and destroying the resources we need to even imagine a future.

First, we warn that the economy is continuously shedding jobs, even dirty and dangerous jobs, and that the carbon budget available before crisis type climate change kicks in will be exhausted soon.

Then we look to a just transition, which needs to re-envision our economy and our society through a widespread, grassroots-based debate. We suggest that some starting points can be identified in a more equal and ecologically sustainable economy, based on people's solidarity that serves people's needs, not profit, such as

- a new energy system based on socially owned renewables;
- new jobs in renewables;
- large scale restoration and detoxification of ecosystems injured by the fossil fuel economy on the Highveld;
- a new and healthier food economy;
- healthier and climate wise housing;
- a new and healthier transport economy;
- a reorientation and expansion of municipal services;
- a basic income grant for all.



Prospects for labour

Workers from the shuttered eMalahleni plants understand that those plants take a heavy toll on human life, including their own. But, says Mzwandile Mangali, formerly of Highveld Steel, “If we don’t have alternatives to dirty plants, we might have to agree to them. I know what it means to not have a wage and no hope of one. Ask someone who has lost their house – would they take a job in a polluting industry? It is better to have a dirty job than not to have any job.”

Such statements have echoed down the decades. In 1998, Josiah Makola was working at Xtrata’s Vantech works where his job was ‘cooking’ vanadium. The chemicals made him ill but the company did not pay due compensation. In an interview with Mpume Nyandu of the Environmental Justice Networking Forum (EJNF), he said, “Even though I know I am dying, I am just persevering because I was told by the company that I will not be employable anywhere else when I leave the company. So I think I am going to die here for the sake of keeping a job so that my child can finish school” [Nyandu 1998: 16]. Xtrata (now Glencore) closed the Vantech mine when the ore was depleted in 2004. It then built the Lion ferrochrome plants on the site.

Even work in a dirty plant, however, is not an option for a large portion of the people. Unemployment has been at around 25% since 1994. In early 2017, it rose to 27.7% according to Stats SA [2017]. That is on the ‘narrow’ definition which excludes people who have given up looking for work. On the broad definition, which includes everyone who wants a job, it is 36.4%. In Mpumalanga, the figures are even higher: 31.5% and 41.2% [Stats SA 2017: 9]. Only 70% of those counted as employed have formal sector jobs and many of them are on contract. More women than men are unemployed. Around half of young people who have left school are unemployed and not in further education.

This is the economy created by imperial capital and, in South Africa, the minerals-energy complex. It has made people largely dependent on dirty jobs for their livelihoods and offers nothing beyond jobs. But it does not provide the jobs.



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There was a time in the rich Northern economies, more or less coinciding with the cold war, when full employment with almost reasonable wages was regarded as an obvious policy goal. In the global South, however, neither was ever on offer. The cold war served as cover for the brutal dispossession of peasants and the repression of labour to enable the extraction of cheap resources to the benefit of the North. In South Africa, the bantustans served as reservoirs of labour for the mines and made the people pay the subsidy of providing the mines with cheap labour. And the system always managed a surplus of reserve labour to suppress wages.

Capital's promise of full employment, even in the North, now appears as an illusion. In eMalahleni, workers see jobs in terminal decline for several reasons. First, the closure of Highveld Steel is most immediately related to cheap imports from China. And they think cheap production in China is made possible by ignoring Chinese workers' rights along with environmental issues such as mine rehabilitation. Second, behind cheap imports are poor policy decisions, notably government's failure to ensure that Kusile used local steel.

Third, they are concerned that the 'fourth industrial revolution' – now being promoted by the World Economic Forum – will dispense with workers. "The first industrial revolution was job intensive. Now all the jobs will be taken by robots." In some ways, this is a continuation of the usual business of using technology to displace labour. Workers observe that no-one is disadvantaged when factory bosses first bring in new technologies. People start losing their jobs three years later. At Highveld, when they re-open the Structural Steel Mill, they will have newer technology and fewer workers. And management will push those workers harder. At Columbus, management restructured work – from a four to a three shift system – to get the same output from fewer workers.

The next round of change will be on a different scale. The Elkem plant at Ferrometals is already computerised, automated, robotised. "The number of workers is reduced so that you now have three where before you might have had 15." And this will not only affect industrial workers. Banks are also shedding jobs and the supermarkets are experimenting with automatic check outs. And driverless cars will soon make even the Uber taxi drivers redundant.



Meanwhile, the whole system is made unstable. “The tables can be turned at any time ...” In short, the workers see diminishing prospects within capitalism. For the growing mass of unemployed people, particularly young people, there is nothing.

It has long been argued that coal-fired power is necessary for economic development and for ‘pulling people out of poverty’. We argue to the contrary: that the world created by the MEC has created poverty and the reproduction of the coal-fired power system will entrench poverty – as it is doing now. Nevertheless, a lot of coal related jobs are on the line and those workers must not be abandoned. At the same time, the MEC economy has produced a society with structural unemployment of close to 40%. Addressing this must be a core part of a just transition. At the end of it we need a more equitable society.

Climate

Climate change is already dangerous. With CO₂ concentrations in the atmosphere hitting 410 parts per million (ppm) at the seasonal high point this year – against the pre-industrial concentration of 280 ppm – the world is now moving towards extreme danger. In Paris in 2015, governments agreed that warming should be limited “to well below 2°C above pre-industrial levels” and, if possible, to below 1.5°C. But this was mere rhetoric. They avoided any common commitment to reduce emissions. And indeed, it is notable that the 1.5°C target was recognised just about the time that it became impossible. That limit will be surpassed in the next few years even if they stop burning fossil fuels tomorrow. Nevertheless, with very steep emissions reductions, it is just possible to avoid 2°C. Possible, but increasingly unlikely with each day that passes without serious emissions reductions.

The 2°C target is sometimes called a climate ‘guardrail’. It is not. As climate scientist James Hansen has repeatedly warned, 2°C is a recipe for disaster. He and his co-authors now warn also that even 1.5°C is too hot [Hansen et al 2008 & 2017]. Four years ago, temperatures were still put at 0.85°C above pre-industrial levels [IPCC 2014c: 3] and already millions of people were



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experiencing climate change as disastrous. Intensified heat waves, droughts and storms affected all parts of the world.

Then came three record breaking years in a row: 2014, 2015 and 2016 were each hotter than the last. 2016 was an El Nino year – when an upwelling of warm water in the Pacific Ocean produces above average global temperatures. What startled the scientists was how much hotter it was – not just above average but above the 2015 record. 2017 is not an El Nino year. It was expected to be much cooler but the first six months are the second hottest after 2016 – still hotter than 2015. So the last four years (including this) are the hottest four years ever recorded.¹⁵¹ Such a sequence is unprecedented and puts the average global temperature for the last five years at over 1.2°C above the pre-industrial temperature. At this rate, climate scientist Michael Mann calculates warming of 2°C by 2036 [Mann 2015].

The risk of runaway climate change – the point at which natural feedbacks become more significant than anthropogenic emissions – is already evident. To take two examples: first, ice and snow are melting around the world. So a white surface that reflects heat outwards melts to reveal a dark surface that absorbs heat. This is known as the loss of albedo. Second, in northern Canada and Russia, large stores of carbon dioxide and methane are stored in permanently frozen peat bogs. This ‘permafrost’ is already beginning to melt and it is releasing increasing amounts of carbon and methane. Hansen et al note that 1.5°C is enough to “spur ‘slow’ amplifying feedbacks”, particularly ice sheet melt leading to sea level rise of several metres [2017: 582]. At 2°C, these risks look like near certainties.

Part 1 of this report opened with a brief account of the impacts of climate change, including the heat, drought and crop failure in southern Africa and particularly in the ‘maize triangle’ of the Highveld in 2015/16. This year on the Highveld, the drought was broken by flooding rain. The maize farmers have harvested a bumper crop with a drop in the price. The price of mealie meal in the shops has also dropped but not by anything like the same amount.

151 See US National Climate Data Centre at the National Oceanic and Atmospheric Administration: State of the Climate: Global Climate Report for June 2017 at www.ncdc.noaa.gov/sotc/global/2017/06/supplemental/page-1



Other foods have increased in price and a basket of basic foods still costs much more than before the drought. A majority of households cannot afford to eat properly.¹⁵²

In KwaZulu-Natal, dams are still very low and, in northern KZN, close to empty. In the Western Cape, poor winter rains have afforded little respite from the drought. Most dams are at critical levels and water restrictions are in place across the province. Cape Town is the first major South African city to be faced with the prospect of the taps running dry. Timber plantations in the catchments double up on the impact of drought and fuelled the wildfires that swirled around Knysna, killing nine and forcing the evacuation of 10 000 people.

In the northern hemisphere, it has been a “hot scary summer”. Northern Europe drowned in flood water while southern Europe burned with deadly heat, drought and wildfires. Temperatures have soared from the Middle East to Mongolia and Siberia. Taiwan was flooded with a metre of rain in two days and a large part of southern China also experienced heavy flooding that affected some 10 million people.¹⁵³ In the month of August, a large part of Freetown, Sierra Leone, was washed away in a mudslide induced by flooding; millions of people lost their homes and crops as much of Bangladesh and neighbouring parts of India and Nepal were inundated; and Hurricane Harvey flooded large parts of the US state of Texas, including an 80 km stretch of oil refineries and storage tanks which then spilled thousands of tonnes of pollutants into the deluge. Harvey was followed by successive hurricanes which devastated the Caribbean.

It is common cause that poor people are most vulnerable to climate change. People living on the fencelines of polluting industries take a double hit, first from the impacts of pollution on their health and environments and second from the impacts of climate change. Children, elderly people and women are the most vulnerable of the vulnerable and women carry most of the extra burden of caring for the sick and disabled.

152 PACSA, Monthly Food Price Barometer: April and June 2017.

153 The World at 1°C, July 2017: *Hot Scary Summer*, Demand Climate Justice.<https://medium.com/@DemandClimateJustice/hot-scary-summer-d1eb31867407>



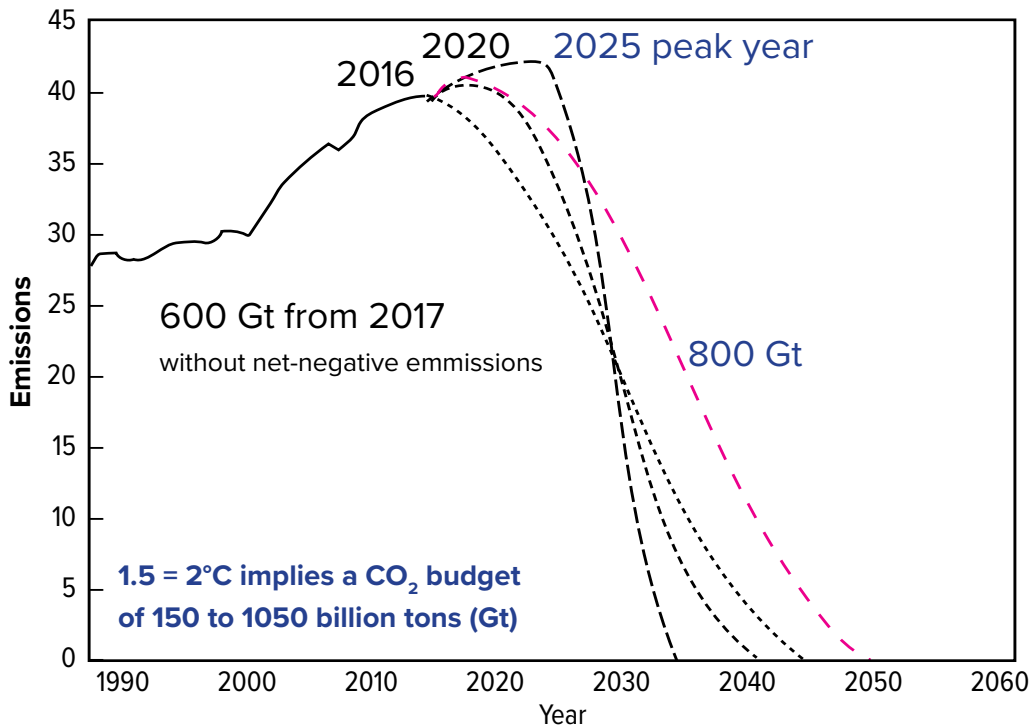
How much can we burn?

For a 'likely chance' (66%) of staying below 2°C, the International Panel on Climate Change (IPCC) gives a 'carbon budget' for 2011 onwards in a range of 630 to 1180 gigatonnes (Gt) CO₂.¹⁵⁴ The same budget gives a less than likely chance (under 50%) of staying below 1.5°C and that's the best chance they give [IPCC 2014: Table SPM1]. In the 2015 groundWork Report, we took the lower end of the range for three reasons: first, because the budget does not accommodate climate feedbacks; second, because sulphur dioxide is emitted along with carbon and sulphur aerosols have a cooling effect – so reducing carbon emissions will also reduce that cooling influence; and third, because the IPCC relies on the untested assumption that large scale “negative emissions” – more carbon is removed from the atmosphere than is emitted – can be achieved in the second half of the century. Finally, we note that a 66% chance is only a two in three chance.

This budget is being consumed at the rate of about 40Gt CO₂ per year and, in 2017, is down from 630 to 350Gt. Without very sharp reductions starting now, this budget will be consumed in the next nine years. Even if a more capacious budget is allowed, global emissions should still peak now. Using updated numbers from the IPCC, Stefan Rahmstorf and Anders Levermann, of the Potsdam Institute for Climate Impact Research, give a budget for a 66% chance of staying below 2°C for 2017 onwards in the range of 150 to 1 050 Gt CO₂. They note that the lower limit will be crossed in the next four years. “Even the CO₂ budget corresponding to the mid-point of this uncertainty range, 600 Gt CO₂, is equivalent to only 15 years of current emissions” [2017: 4]. This budget does not rely on negative emissions but it also takes no account of sulphur aerosols or climate feedbacks.

154 A gigatonne is a billion tonnes.



Figure 3: Three scenarios for staying below 2°C

Source: Rahmstorf & Levermann 2017.

In figure 3, Rahmstorf and Levermann show three scenarios using the 600 Gt budget with different dates for peak emissions. It shows that, if CO₂ emissions had peaked in 2016, there would be 30 years in which to reduce emissions to zero. If emissions peak in 2020, there are 20 years to reduce to zero. Peaking in 2025 leaves only 10 years to transform the global economy and this is not regarded as possible because it leaves too little time. Rahmstorf and Levermann conclude that peaking by 2020 is the last chance. The dashed line allows a budget of 800 rather than 600 Gt CO₂ but would significantly increase the “risk of exceeding 2°C warming” [4].

The coal, oil and gas from ‘developed reserves’ – that is, working mines and wells – contains about 942 Gt CO₂, as calculated by Oil Change International [2016: 19]. That’s already much higher than even the relaxed 800 Gt budget. To it must be added another 162 Gt of committed emissions from existing



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cement kilns and an estimated 21 Gt from land use change to bring the total to 1 125 Gt – nearly twice the 600 Gt budget and over three times the 350 Gt budget, higher even than the 1 050 Gt at the top of Rahmstorf and Levermann's range and over seven times the 150 Gt lower limit.

Hence, it is not just fossil fuel reserves – the stuff that the corporations have booked as ready for development at current prices – amounting to about 2 600 Gt CO₂ that must be abandoned. For a ghost's chance of avoiding 2°C, exploration must stop, new developments must be cancelled and a significant proportion of working mines and wells – together with power stations and refineries – must be closed ahead of schedule. In short, the entire fossil fuel industry should now be working towards closure.

Whether we take 150, 350 or 600 Gt CO₂ as the remaining budget, the world is well behind any reasonable schedule in reducing emissions. Northern countries are more than a decade behind. In 2011, Kevin Anderson and Alice Bows of the Tyndall Centre, calculated the steep Northern reductions required to allow Southern countries with big emissions some latitude in line with the principle of common but differentiated responsibilities. Assuming the steepest possible Northern reductions, Southern country emissions still had to peak in 2020 or 2025. Following a 2020 peak, they would need to reduce emissions steeply by 4 to 5% per year. If they delayed peaking to 2025, they would need to reduce emissions very steeply at 7% per year [Anderson & Bows 2011]. These calculations were for all Southern countries, indicating that those with high emissions, including South Africa, should peak sooner and reduce faster than those with low emissions. Even then, there was no room for the plateau as in South Africa's peak, plateau and decline (PPD) trajectory.¹⁵⁵

What was possible in 2011 is no longer possible. Any chance of avoiding 2°C warming now depends on all countries with significant emissions, North and South, reducing as fast as possible while countries with low emissions avoid getting onto the carbon treadmill. Common but differentiated responsibilities should then be accounted for in money terms as part of the climate debt

¹⁵⁵ For a detailed critique of South Africa's peak, plateau and decline (PPD) trajectory, see groundWork Report 2015.



owed by the North to the South. While the North avoids discussion of that debt, Southern elites avoid discussion of the debt owed by rich to poor in all countries.

It is also urgent that the earth is restored. From 1750 to 2011, burning fossil fuels has released 1 340 Gt CO₂ into the atmosphere. “Deforestation and other land use change” – that is, land clearing and industrialised logging, agriculture and plantations – have put another 660 Gt CO₂ into the air [IPCC 2013: 7]. Restoring earth through regenerative agriculture and the restoration of forests and grasslands would result in a large portion of this “above ground” carbon being reabsorbed. Hansen et al reckon on 367 Gt being reabsorbed by such means [2017: 590]. This is not to enlarge the carbon budget but to reduce carbon concentrations in the atmosphere.

It should be said that there are no longer certain outcomes. Even if all governments suddenly committed to reduce emissions as fast as possible, it is now so late in the day that it is hit and miss as to whether climate change is already a runaway or can be reined in. What is certain is that the longer the elites delay serious action, the hotter it will get. At some point, probably around 2°C, it will become questionable as to how the present organisation of states and economy will hold up in the face of severe climate disruption.

Yet no country is planning to reduce emissions with due urgency and all are intent on not understanding what needs to be done to meet the 2°C target. They will also avoid any more serious discussion about whether 2°C, or even 1.5°C, is actually an appropriate target or whether the aim should be to reduce the concentration of greenhouse gases in the atmosphere as argued by Hansen et al [2017]. In this context, Ricardo Navarro of Friends of the Earth El Salvador argues that communities need to develop mechanisms for survival [2016].



Just transition

The distinction between mitigation and adaptation has some uses but it also creates a false division and produces disjointed and sometimes contradictory responses to climate change – as the notion of ‘perverse adaptation’ indicates. Thus, for example, everything to do with coal is regarded as mitigation whereas adaptation is typically centred on biodiversity and water conservation. Restoring the earth, however, is as necessary for mitigation as for adaptation while, on the other hand, mining and burning coal destroys adaptive capacity just as surely as it drives climate change. And adaptive capacity is about people’s health as much as ecological health.

The concept of the just transition emerged from the north American trade union movement, according to Anabella Rosenberg [2017]. The primary concern was the potential loss of jobs in the “fossil-based economy” as a consequence of mitigation policies. This is one of two approaches to a just transition that Jacklyn Cock [2016] observes within the labour movement. It is largely defensive and aims to protect workers whose jobs are on the line through retraining for other jobs in supposedly ‘green’ or low carbon industries.

The second approach aims at the transformation of the system as a whole towards democratic, egalitarian and ecological forms of producing and consuming. In our view, this puts a just transition at the core of a climate response that integrates adaptation with mitigation. And it is as much about people without jobs as it is about people who might lose their jobs and, at base, it is about making a society of equals.

The first approach provides a temporary reprieve but is a dead end. Irrespective of climate change, the present system is not producing the jobs now and looks set to dispense with all but a shrinking number of skilled workers. Shifting jobs from a dirty to a clean industry matters little if there are no jobs to be shifted. Dirty or clean, workers are abandoned to the growing ranks of unemployment. In eMalahleni, the metal workers commented that, since “each worker supports nine or ten people, in 20 years this is going to be



a disaster... already, it has given rise to xenophobia... everybody will fight for a slice of bread.”

Cosatu’s climate policy mixes in elements of the defensive approach but, at heart, it seeks transformation. It is based on 15 ‘principles’ intended to link “the principles of sustainability and justice” [Cock 2016: np]. Principle 1 states that the underlying “cause of the climate crisis is the expansionist logic of the capitalist system” and it calls for production to meet “the real needs of people” rather than to create profits for the owners of capital. The subsequent principles address various aspects of climate policy and people’s rights – including the rights to food, water and energy. Principle 8 says “a just transition addresses both the unemployment crisis and the ecological crisis”.¹⁵⁶

The policy was developed over five years from 2009 and involved 22 of the affiliate unions. The process died when Cosatu split but the policy is still in place and provides a valuable resource. However, Cock, who was part of the team that worked on the policy, now believes that “we focused too much on principled rather than strategic questions” [2016]. It addressed the long term interests of workers but not their short term interests, in particular their fear of losing their jobs.

At the same time, the Million Climate Jobs campaign brought together unions, social movements and environmental organisations to do that. It was initiated on the premise that addressing climate change requires a great deal of work that the private sector will not do because, for the most part, there is no profit in it. The campaign kicked off in 2010 with research across various economic sectors to assess how many climate jobs could be created.¹⁵⁷ In a follow up report this year, campaign coordinators recognise that there have been many relevant developments since, notably the renewable energy process.

But most of these solutions are being pursued within the logic of the market. It is not possible, we would argue, within these market

156 Cosatu Policy Framework on Climate Change: Adopted by the Cosatu Central Executive Committee, August 2011. The framework is the basis for Cosatu’s policy on climate change: *A just transition to a low carbon and climate resilient economy*, published as a booklet in 2016.

157 One Million Climate Jobs Campaign booklet (MCJ 2011).



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parameters, to respond adequately to the enormous challenges facing us – what is needed is a publicly-driven solution for the shift to a sustainable, low-carbon future.¹⁵⁸

A third initiative, Numsa's campaign for socially owned renewables, kicked off in 2011. It envisioned "a mix of different forms of collective ownership", including state-owned, municipal-owned, co-operatives and "other forms of community energy enterprises".¹⁵⁹ It was concerned not just with ownership but also with democratic control and the distribution of the economic benefits of production. Numsa also brought an awareness of the implications of the privatised development of renewable energy with case studies showing that, within the logic of the market, a transnational corporation is a transnational corporation for all that its business is renewable energy. Case studies showed, amongst others, land-grabbing by wind corporations in Mexico and the extractivist logic of Desertec, an initiative by European energy corporations in north Africa. And several TNCs, including some now active in South Africa, are equally happy building a coal-fired power station as a wind farm – their concern is profit, not the climate.

These initiatives have stimulated debate and awareness but as yet have had limited traction on the shop floor and at the grass roots. Numsa workers note that "this thinking" about environmental conditions in general and a just transition in particular is new to the union. But in eMalahleni, Middelburg and Secunda, they emphasised that "we are part of the community" and "we face the same crises of water shortage and water and air pollution". As to climate change:

It is going to be bad. In Witbank and Highveld we have power stations around us and our members are there. The influence of those power stations and big companies in terms of emissions is very big. In 10 to 30 years we will be having a very serious challenge. When I was young

158 The follow up report is forthcoming in 2017 from MCJ and Alternative Information and Development Centre AIDC, written by Brian Ashley, Dick Forslund, Thembeke Majali, Jonathan Neale (editor), Jeff Rudin and Sandra van Niekerk.

159 Karl Cloete, Numsa Deputy-General Secretary, *Envisioning a socially-owned renewable energy sector – A Numsa perspective*. Speech to Numsa International Conference, 4-8 February 2012.



it was raining more than now and it was not hot like now. Before, on the Highveld, there would not be more than 10 days over 30 degrees. Now it's like being in Limpopo or Nelspruit. We did a 2015 workshop on carbon emissions but it was run at head office and never went to the locals to share this knowledge.¹⁶⁰

Workers concluded that “we need to mobilise and link with community struggles”. They recalled a 2013 Numsa conference resolution to create “a United Front in every community”. They are also part of the formation of the new labour federation – the South African Federation of Trade Unions (Saftu). Older workers recalled the 1980s with the simultaneous formation of the United Democratic Front (UDF) and Cosatu.

In Part 1, *Digging Coal*, we noted that the central coal basin on the Highveld is in decline and there needs to be an inclusive process of debate and planning for the closure of coal mining in the whole region. The Department of Mineral Resources (DMR), however, is barely able to process the closure of individual mines and avoids any discussion of regional closure. We suggested that the debate on life after coal on the Highveld should be led by the people of the Highveld. This question of life after coal is, precisely, the question of a just transition.

Starting points

There are several elements to a debate on a just transition on the Highveld that suggest themselves. Some elements are about urgently needed work on the Highveld. Others are suggestions for a broader response. All would require a politics driven by communities and workers, both formal and informal.

As observed in Part 1, the mining houses have left a mess. The mines can never be fully rehabilitated but rehabilitation is necessary to limit the damage to land and water as far as is possible. Coal mining regions are littered with abandoned mines. Even where mines are supposedly rehabilitated – to standards that do not restore the vitality of soils and ecosystems – it is done on the cheap.

¹⁶⁰ Interview with Numsa Middelburg shop stewards, 10 March 2017.



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On present trends, we can anticipate that the regions themselves will be abandoned as toxic wastelands. A just transition requires a programme for rehabilitating not just individual mines but the coal mining regions as a whole. This is a process that would employ thousands of mine workers amongst others. Rehabilitation of mines must go hand in hand with rehabilitation of wetlands and rivers.

Many Highveld townships are terribly neglected. In KwaGuqa, for example, the roads are rutted and potholed and are flooded even in light rain. The sewers overflow and the rubbish accumulates on street corners. Electricity and water are frequently cut off for lack of maintenance or, in the case of electricity, because eMalahleni is not paying its Eskom bill. There is much work to be done just fixing things. But there is also a need, and an opportunity, to design urban space and infrastructure in anticipation of the intensified storms and droughts that climate change will bring.

The quality of housing affects people's comfort and their energy use. Many people live in tin shacks which bake in summer, freeze in winter and leak when it rains. RDP houses are not much better. They don't have ceilings or any other form of insulation and many of them are cracking up because they were badly built. On the Highveld many more houses are cracking up because of mine blasting. Simple changes to design and building methods can make comfortable homes that cost little to keep warm or cool. The need for large scale programmes to upgrade people's homes and settlements is already urgent and will become more so as climate change intensifies.

Across South Africa, many people walk to work and school but our towns are planned as if everyone has cars. Settlements should be designed to put work and amenities within reach and to make walking and cycling the easy option. Such 'active transport', as the Lancet Commission on Health and Climate Change [Watts et al 2015] calls it, also has major health benefits. For longer trips, people need a good, low cost public transport system. It needs to be safe and reliable and serve everyone. It needs to get the middle classes out of their cars as well as giving the working classes freedom of movement.



Municipal systems also need reinvention. For example, working towards a zero waste economy would involve separation at source, high levels of recycling and composting of organic wastes. Such an initiative would need the participation of waste pickers, municipal workers and communities. Where the broken sewage plants must be replaced, municipalities could introduce bio-gas digesters to produce energy even as they treat sewage. Renewable energy technologies, particularly solar PV, are suited to decentralising the energy system. This creates the opportunity for ‘people’s energy sovereignty’ – social ownership and democratic control of production and consumption at community and municipal levels. Large, utility-scale solar farms might also be constructed on old coal fields which remain barren even after the best efforts of rehabilitation.

As noted above, a fully renewable national energy system costs less and provides more jobs than a system that remains reliant on coal-fired ‘base load’. Nuclear base load is massively more expensive and would employ fewer people. At present – and unless the robots are allowed to take over altogether – a significant proportion of renewable jobs are in manufacturing. Much of the equipment for the REIPPPP has been imported – as is also the case with Medupi and Kusile. But factories will locate in South Africa if there is a large and reliable line up of renewable projects.

The Million Climate Jobs campaign looks to build enough to supply all South Africa’s electricity demand from renewables by 2038. That would mean building 15 000 MW of wind and solar power every year. The CSIR’s ‘decarbonised’ scenario does not eliminate coal fired power until the late 2040s and requires around 9 000 MW a year. That compares with a total of 6 300 MW contracted through the REIPPPP by 2017. Either way, that’s enough to attract considerable manufacturing capacity. It will also sustain a large number of construction jobs and growing numbers of maintenance and operations jobs. Creating a ‘smart grid’ to go with renewables will also require more jobs than the conventional grid. The Million Climate Jobs team calculates 250 000 jobs at the start of a determined renewable build programme with another 88 000 maintenance and operations jobs by the end of the period. Eskom at present employs 48 000 people.



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And there is still some use for the old power stations in a renewable system. After the coal-fired boilers are decommissioned, some of the generators at well maintained plant can be used as flywheels for energy storage and grid stability in a grid powered by renewables.

Food is energy for people. As noted in Part 1, climate change makes for a higher risk of crop failure. So long as the food system is controlled by the market, food prices will be increasingly volatile while trending higher. The idea of energy sovereignty borrows from the idea of food sovereignty put forward by La Via Campesina, the global movement of peasant farmers. They look for democratic control of a food system based on people's right "to healthy and culturally appropriate food produced through ecologically sound and sustainable methods ..." ¹⁶¹ This implies a determined shift to organic production and sustained programmes for agrarian reform and urban agriculture. At the very least, making food gardens in the townships of the Highveld would supplement household incomes.

Of course, making food gardens under a polluted sky is not necessarily a good idea since toxins are taken up in the food itself. But the air cleans up very quickly when the polluting plants are switched off. Many people have told us that their health, and particularly their children's health, improves even on short visits to family in unpolluted places. This is why the Lancet Commission on Health and Climate Change says that "tackling climate change could be the greatest global health opportunity of this century" [Watts et al 2015: 1]. On the Highveld, the rapid phase out of coal burning would lift a burden from people's bodies.

Given very high structural unemployment in South Africa, a million climate jobs would surely make a difference but might not end unemployment. Besides, a million climate jobs is something to be fought for. It is not on government's agenda as yet. In 2002, the Taylor Committee on social security noted that "South Africa is characterised by a labour surplus economy that is unlikely to change in the foreseeable future" [Taylor et al 2002: 17]. It therefore recommended the adoption of a Basic Income Grant (BIG) "provided ... without

161 La Via Campesina, Nyeleni Declaration, 2007.



a means test ... as a social entitlement for all South Africans” [61]. Everyone would get it but those with jobs would pay it back in taxes and the rich would pay more than they got from it. In this way, it would be administratively simple and would avoid stigmatising poverty by defining recipients in Victorian terms as ‘indigents’. The committee observed that a BIG would enable more active participation of poor people in all areas of life, including the economic. Far from creating dependency, as asserted by government along with the World Bank and other elite institutions, it would promote self-reliance.

Finally, the DEA’s draft National Adaptation Strategy (NAS) says it “recognises that the climate change challenge requires a paradigm shift in South Africa’s sustainable development agenda” [23]. We agree, although we note the implication that South Africa’s sustainable development agenda is short on sustainability. As reflected by the National Development Plan, the Nationally Determined Contribution – South Africa’s submission to the Paris Agreement on Climate Change – and the NAS itself, economic growth remains the central organising principle of economy and all related policy. Never-ending growth, however, is not compatible with serious mitigation or adaptation [Anderson and Bows 2008]. To address climate change and meet the needs of people, there must be a radical redefinition of what is meant by development and who defines it.

We believe that the central organising principle of economy should be sustainability founded on economic, social and environmental justice. This means a commitment to growing human solidarity and equality as well as a relationship to the environment which enhances rather than degrades the functioning of eco-systems both for their intrinsic value and for the eco ‘services’ they provide. The Constitutional justification of such a redefinition is found in the Environment Right. This does not imply that economy and production are unimportant, but that the economy must serve people rather than people serving the economy. This would create the basis for a just transition.



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In the meantime, we have to be vigilant to maintain and rebuild grassroots democracy, and to see through the active lies and false promises of a dying fossil fuel economy. False solutions to the climate and ecological crisis include the various forms of 'clean coal' – always a contradiction in terms – and nuclear power, as well as privatised renewable energies and other green economy 'solutions'.



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The violence of production hangs in the air of the Highveld. Air pollution from big industries burning coal kills thousands of people every year. Hundreds of thousands more suffer debilitating illness. This scandal goes unseen. The health system does not register what is happening and these deaths and illnesses are not reported in official records or in the media. It is not just that the bodies cannot be lined up for inspection. The majority of those who die early are poor and live alongside the polluting plants. Some work in those plants. In the context of high unemployment, they are glad of an income but expect an early death as the cost of it. That these deaths remain invisible is convenient to the political and economic elite. The environmental injustice and racism of the apartheid regime was handed on to the new South Africa as if it were natural to development.

Part 1 of *The Destruction of the Highveld* focused on the politics and impacts of mining coal. Part 2 focuses on burning coal and the dirty politics that accompanies it – in Eskom’s power stations, in Sasol’s coal-to-liquids petrochemical plants, and in the big metal smelters that dominate the industrial landscape of eMalahleni and Middelburg. It reports on the experience of fence-line communities and workers, on people’s struggles for clean air to breathe and on the slow and partial responses to this growing environmental health crisis by a reluctant regulator. The pollution of air and water is immensely destructive. Coal fired energy and industry is also a primary driver of climate change. This report points to the urgency of a just transition to a changed economic and political system shaped by the workers and communities who are marginalised within the present system.



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