CHAPTER 6

South Africa's Dilemma: Reconciling Energy-Climate Challenges with Global Climate Responsibilities

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Introduction

In a carbon-constrained environment, South Africa's national strategy must be informed by international realities, including a growing pressure for quantified emission–reduction commitments. This chapter offers the following: an assessment of the state of the climate change and energy debates in South Africa; the causes of major emissions and important players; the impacts and vulnerability experienced in the entire Southern Africa region; and an overview of South Africa's national policies and areas of international consideration. It consists of various sections highlighting some of the most important elements of this debate. It firstly describes South Africa as a major carbon dioxide emitting country; and it breaks down South Africa's energy consumption patterns by sector and describes the make-up and profile of these emissions. The chapter then goes on to explain the reliance on coal for electricity production in South Africa.

The chapter describes some of the climate change challenges facing South Africa in the strategic dilemma of balancing development needs, energy access and security, while simultaneously curbing greenhouse gas (GHG) emissions. Given the apparent trade-off between climate change

actions and a development path based on cheap but dirty electricity generation, the chapter considers both and the likely cost of mitigation (or changing from a 'business as usual' scenario), paying attention to potential costs of adaptation to climate change.

It is important to investigate key players and stakeholders, including ministries and departments driving climate change decisions and processes. South African parastatal Eskom, for example, carries tremendous weight in any decision to move to cleaner, more sustainable electricity. It is also crucial to understand what informs South Africa's actions to curb domestic emissions. This chapter thus provides an overview of South Africa's long-term mitigation scenarios (LTMS) and interrogates the various market mechanisms (tax incentives and subsidies) available to promote the desired move to a low-carbon future through increased investment in renewable energy (RE) sources and carbon-efficient technology.

The chapter also offers perspectives as to the role the country plays multilaterally — and why. South Africa has a significant leadership role in international negotiations under the UN Framework Convention on Climate Change (UNFCCC). It has sought to strengthen co-operative alliances with Africa and the developing world in pursuit of a more equitable post-Kyoto climate regime. It has been particularly vocal in trying to ensure that the developed world offers financial support and technology transfer to enable Africa to adapt. And it has encouraged a regime in which Africa can realise the economic opportunities offered under Kyoto's flexible mechanisms, namely the Clean Development Mechanism (CDM).

South Africa as a global carbon dioxide emitter

South Africa differs from its neighbours in several respects. Firstly, it is the largest emitter of GHGs in Africa, primarily because of the relative size of its economy, its large manufacturing and industrial base, and its dependence on coal for energy. It is responsible for 39% of emissions on the continent,[1] and is one of the greatest sources of pollution on a per capita basis in the developing world.[2] Eskom alone generates about 350 million tonnes of carbon dioxide (CO_2) a year.[3]

Of the 53 countries in the African Union, 95% of CO_2 emissions emanate from only 15 states, including South Africa (see Table 6.1). Big emitters include Nigeria and Angola, which are oil producers (in the

Niger Delta, 100 million tonnes of CO_2 come from gas flaring every year), and agrarian economies like Ethiopia and Ghana.

Table 6.1: CO_2 emissions in Africa, 1990 & 2004

	Total of CO_2 emissions (million tonnes)		CO_2 emissions per capita (tonnes)	
Country	**1990**	**2004**	**1990**	**2004**
1. South Africa	331.8	436.8	9.1	9.8
2. Algeria	77.0	193.9	3.0	5.5
3. Egypt	75.4	158.1	1.5	2.3
4. Nigeria	45.3	114.0	0.5	0.9
5. Libyan Arab Jamahiriya	37.8	59.9	9.1	9.3
6. Morocco	23.5	41.1	1.0	1.4
7. Tunisia	10.1	21.1	0.9	1.0
8. Zimbabwe	16.6	10.6	1.6	0.8
9. Kenya	5.8	10.6	0.3	0.3
10. Sudan	5.4	10.4	0.2	0.3
11. Ethiopia	3.0	8.0	0.1	0.1
12. Angola	4.6	7.9	0.5	0.7
13. Ghana	3.8	7.2	0.3	0.3
14. Equatorial Guinea	0.1	5.4	0.3	10.5
15. Senegal	3.1	5.0	0.4	0.4

Source: UNDP, *op. cit.* and Human Development Report, 2007/2008

Table 6.2 on the following page lists the 12 highest CO_2 emitters globally, in terms of total emissions per million tonnes (2004) and their share of total world emissions. According to the 2004 *UNDP Development Report*, South Africa contributes 1.5% of net worldwide GHG emissions.[4]

Table 6.3 shows that South Africa also has one of the highest emission intensities among developing countries.[5] Estimates based on data from the Carbon Dioxide Information Analysis Center and the *UNDP Development Report* put its CO_2 emissions per capita in 2004 at 9.8 tonnes, equal to Germany's.[6]

Table 6.2: Top 12 CO_2 emitters, 2004

Country and rank	Total of CO_2 emissions (million tonnes)	Share of world total (%)
1. US	6 046	20.9
2. China	5 007	17.3
3. Russian Federation	1 524	5.3
4. India	1 342	4.6
5. Japan	1 257	4.3
6. Germany	808	2.8
7. Canada	639	2.2
8. UK	587	2.0
9. South Korea	465	1.6
10. Italy	450	1.6
11. Mexico	438	1.5
12. South Africa	**437**	**1.5**

Source: UNDP, *op. cit*., Appendix, p. 31

Table 6.3: CO_2 emissions per capita (tonnes) in selected countries, 2004

US	20.6
Germany	9.8
South Africa	**9.8**
Mexico	4.2
China	3.8
Brazil	1.8
India	1.2

Source: Based on data from CDIAC, *op. cit*.; correspondence on CO_2 emissions

While South Africa's progress towards energy sustainability does not fare well on indicators such as per capita carbon emissions, particulate concentrations, cleaner energy investment, energy intensity and the use of renewable energy sources, there is a very real counter-debate: the importance of its economy to the region. It is a regional hub generating two-thirds of the gross domestic product of the Southern African Development Community (SADC) and 60% of all intra-SADC trade in sectors like mining, electricity, oil and gas.[7]

In addition, the figures above do not accurately reflect the inverse relationship between countries responsible for climate change and those most vulnerable to its effects. Developing countries argue that historical GHG emissions should be taken into account, as well as their current level of development, economic growth, population or industrialisation.[8]

South Africa, for example, contributed only 1% of global GHG from 1950 to 2000 and currently contributes 1.5%[9] — not a massive contribution compared to other developing nations.

Africa's contribution to current and historical global levels is also negligible. Representing 14% of the world's population, it is responsible for 3.6% of all fossil fuel emissions.[10] Most of those derive from the energy and transport sectors, both essential to sustaining economic development.

For a country like South Africa, whose priorities are poverty alleviation and job creation, the challenge of reducing emissions while retaining competitiveness remains daunting. However, it recognises that exports will be affected if it does not take note of international realities, including the growing pressure for quantified commitments. Developed countries are generally net importers of CO_2 emissions, as emissions associated with production are lower than emissions associated with consumption. For developing countries, more GHGs are emitted in production than in consumption. Of South Africa's GHG emissions, 40% originate from export-related goods, mainly precious minerals and resources.[11]

This dilemma, faced by most developing countries, is particularly acute in South Africa because of disparities in income and sustainable living, and the make-up of its industrial and energy complex. Mitigation is very much a challenge of making development more sustainable.[12] However, the reverse is also true: sustainable development has the potential to contribute to mitigation. Thus, South Africa seeks to combine the approaches, giving priority to sustainable economic development while nevertheless responding to the need for climate change and sustainability.

The apparent conflict between addressing climate change and fostering development presents a dilemma for democratic governance in the developing world. Governments have to agree to pay substantial initial costs for mitigation and adaptation programmes with a view to long-term gains — no matter how unpopular these decisions seem to the poor. South Africa will need to budget for climate costs and consumers will have to pay much more for electricity. A climate focus will require leaders to look beyond electoral cycles and educate their communities — particularly those most vulnerable to climatic threats — to accept policy changes. Given other pressing issues in the developing world, this is generally not a priority of incumbent administrations.

Energy consumption by sector in South Africa's economy

Table 6.4 shows that CO_2 from the supply and use of energy is the biggest contributor to emissions in South Africa. The economy is energy intensive because of heavy industries like mining, an inefficient fossil fuel electricity supply system and sprawling urban areas. South Africa's mineral–energy complex, for example, comprises large scale primary extraction, minerals processing and linked industries based on mining and beneficiation, underpinned by some of the cheapest electricity in the world.[13] Transport emissions have also increased substantially over the past few decades.

Table 6.4: South Africa's GHG emissions — make-up and profile

CO_2 is the most significant GHG in South Africa, making up 80% of total emissions. Two major sectors contribute — energy (91.1%) and industrial processes (8.9%).[14]
Methane is the second-largest GHG produced, accounting for 11.4% of emissions. Main sources are agriculture, fugitive emissions and waste. Of total methane emissions, livestock contributes 40%, and landfill sites and wastewater treatment facilities about 33%. These figures are expected to grow as waste collection services are extended to poorer communities.
Nitrous oxide is the third-largest GHG, accounting for 5.5% of emissions. About 82% originates from agricultural soils, manure and synthetic fertilisers. Production of nitric acid contributes a little above 10%.

But the production and distribution of energy contributes about 15% of South Africa's GDP, employs approximately 250 000 people[15] and is crucial to the economic development of the whole region and to maintaining the country's ambitious economic growth projections. Table 6.5 shows that industry is the largest energy consumer. However, the two fastest-growing sectors for emissions are transport (27%) and the built environment (26%).

Table 6.5: Proportion of energy consumption by sector in South Africa, 2006

Industry – 36%
Transport – 27%
Residential – 26%
Commerce and public services – 7%
Agriculture – 3%
Non-specific (other) – 1%

Source: Aggregate energy statistics of the Department of Minerals and Energy, 2006

Long distances, high altitudes and increased motorised transport contribute growing amounts. The largest 16 urban environments occupy less than 3% of the land, yet they consume more than 50% of energy supplied.[16] This is expected to increase as the government attempts to meet its target of 300 000 new houses a year. Commercial and services sectors contribute very little to emissions, yet are responsible for two-thirds of South Africa's GDP and provide almost half the employment. Agriculture also creates more jobs with less energy.

Using coal for electricity production

Coal provides 72% of South Africa's total energy mix[17] and, in 2008, more than 90% of its electricity. See Annexe 1 for a breakdown of South Africa's actual energy sources. One-third of electricity is consumed by households and two-thirds by business and industry.[18]

Eskom produces at least 95% of its electricity through coal-fired power stations, and supplies the neighbouring countries of Swaziland, Mozambique, Zimbabwe, Botswana and Namibia.[19] In 2008, Botswana, for example, received 75% of its total power needs from South Africa. Eskom is one of the world's 10 biggest electricity generators and is said to produce 45% of the continent's electricity.[20] But coal, considered a dirty source, makes up more than 40% of South Africa's total emissions.[21]

Despite a national electrification scheme and subsidised electricity, the urban poor continue to choose dirtier but more affordable fuels like biomass, paraffin and domestic coal for their poorly insulated houses and shacks. Low-income families spend 12–20% of their income on fuel, compared to 2% in high-income homes.[22]

Industry

In industry, coal is used among other things to produce steam, coke for the steel industry and synthetic liquids. According to statistics from the International Energy Agency (IEA), South Africa's two commercial-sized coal-to-liquids plants (Sasol II and Sasol III) can produce 150 000 barrels of fuel a day, supplying 36% of the country's total petroleum fuel requirements.[23] It also provides 200 000 direct and indirect jobs, contributes South African rand (ZAR) 34 billion annually to South Africa's GDP and produces 23% of the country's required coal.[24] Despite its contribution to growth, Sasol's environmental record is extremely poor. It produces an estimated 21% of South Africa's total GHG

emissions a year and its Secunda plant is the world's second-largest single emitter of CO_2, having emitted approximately 73 million tonnes of GHG in 2008.

Climate change challenges facing South Africa: Present and future

South Africa's climate question is simultaneously an energy, carbon and development one, and its national response is motivated by the strategic dilemma of how to balance development and poverty alleviation goals, energy access, security needs and international competition against pressures to curb GHG emissions.

Energy demand will continue to increase. Integral to the country's growth initiative is to provide electricity by 2012 to the 30% of its population that is without it. The national transmission grid currently covers 27 000 km of South Africa — there is a massive drive to increase the extent of the population with access to electricity, particularly in remote rural areas.

If supply is based on coal-fired systems (especially from low grades currently used), as presently planned, GHG emissions will increase rapidly. There is an urgent need for a thorough impact assessment in all major sectors. An important strategic question needs to be asked: are there opportunities to be found in transforming to a more carbon-efficient environment led by technology and services?[25]

The economy is highly dependent on income from producing, processing, exporting and consuming coal. According to Keaton Energy, South Africa is the fifth-largest producer in the world and the fourth-largest exporter.[26] In 2007, South Africa had proved coal reserves of 48 000 million tonnes.[27]

Energy pricing is also an important consideration. Coal-fired power stations in South Africa can burn low-grade coal and generate electricity cheaply. This has been helpful to increase the access to electricity of average South African households, from 36% to 70% since 1990. Until recently, South African electricity has been cheap by international standards, making other energy sources less competitive. Against that, cheap electricity has been an important incentive to international investors.

But a dilemma remains: a huge number of households are still without electricity while the energy sector generates a massive percentage of the

country's GHG emissions. More challenging still is that alternatives to coal-based electricity are expensive. South Africa has little or no hydro-electricity potential; solar and wind power are only viable in areas remote from the national grid; and for security reasons, the country cannot depend solely on countries in the region with an abundance of hydro power. Fossil-fuelled thermal power stations, on the other hand, can be built more quickly than nuclear ones; and South Africa's export potential is being boosted by increased international demand for low-grade coal. India, for example, is looking to diversify its supply for new thermal power stations after congestion at Australian ports.[28]

South Africa has been looking to the region for alternatives to coal: hydro-electricity from Cahora-Bassa in Mozambique[29] and the Great Inga Dam project in the Democratic Republic of the Congo.[30] Mozambique is providing natural gas to Sasol in Secunda.[31] The country is also looking to its international partners such as France, China and Germany for nuclear facilities.

However, despite the myriad opportunities and abundance of natural resources indicated above, regional co-operation is limited and the Southern African Power Pool has produced delayed results. The region does not produce clean technologies, relying on expensive imports. It lacks expertise, and governance is still a challenge. Instability and civil war (in Mozambique until 1992 and in the Democratic Republic of Congo) have stalled progress. The Inga megaproject centralises much of Africa's electricity sources and requires transmission lines through politically unstable regions. Dams, power plants and transmission lines are often targeted in political conflicts. Climate change brings risks of droughts and floods.

Eskom

Eskom dominates the electric power industry. A parastatal, it supplies internal markets and buys from and sells to SADC countries. It generates about 95% of South Africa's electricity consumption and supplies about 45% of Africa's electricity.[32]

Its 2008 annual report reveals that its GHG emissions rose from 208.9 million tonnes in 2007 to 223.6 million in 2008.[33] (This is staggering considering that Shell Global produced only half this amount). Eskom, for example, has a generating capacity of 36 200 megawatts (MW), of which coal-fired capacity constitutes 32 100 MW. Renewable energy

currently only produces approximately 1% of the electricity generation.[34]

Despite its large existing carbon footprint, Eskom embarked on a massive programme in 2008 to upgrade and expand its infrastructure after power outages forced household and industrial rationing. It will spend ZAR 1.2 trillion by 2025, including ZAR 343 billion over five years (2008–2013) to fund new generation power stations, the first due to come online in 2013. Eskom has also decided to restart three large mothballed coal-fired plants that have been closed for more than a decade (Camden, Grootvlei and Komati power stations). In addition, it is going ahead with the construction of two new coal-fired power stations (Medupi and Kusile), which together will provide Eskom with 9 600 MW of new baseload capacity.[35] Eskom is hoping that through the expansion of future infrastructure it will increase its capacity from 36 200 MW to 80 000 MW by 2026.

Power shortages and a general lack of spare generation capacity in Southern Africa have led to increased interest in new coal-fired power projects in Botswana, Mozambique and Tanzania. Eskom is establishing new power lines in Namibia, and is investigating rural electrification options in East Africa. Offices have been established in Uganda and Mozambique, and future work is being targeted in other countries, including Libya.

South Africa achieved cheaper electricity by subsidising connections for consumers/households and providing a free allocation of 70 kilowatt hours (kWh) of electricity a month. Eskom's average cost of US$0.03 per kWh for 2008 compares very favourably with the US$0.08–0.09 for OECD countries. However, the power utility is now under pressure to double power generation in the face of a record ZAR 9.7 billion loss in its 2008/9 financial year. It will come at a cost to electricity consumers. Tariffs rose 27.5% in 2008 and a further 31.3% in 2009. According to Bobby Godsell, then chairman of Eskom, this amount is likely to continue increasing to 60% or 80–86c/kWh.[36]

Eskom is also exploring non-fossil fuel options to add additional base-load supply to the national grid. Ex-chairman Godsell outlined plans to reduce coal dependency from 90% to 70% by 2026 by increasing nuclear energy's contribution from 5% to 20%, and increasing imported hydro-electricity from 5% to 10%.[37, 38] He suggested that wind, solar and biomass, previously not a focus, 'can provide more immediate transmission and use'. Plans were to establish a large wind farm off

the west coast and a 100 MW solar plant. Despite such encouraging statements, Eskom has implemented very few of these projects.

Assessing future mitigation options

In 2006, South Africa's then Department of Environmental Affairs and Tourism initiated an ambitious exercise to determine an appropriate national climate change response. It created LTMS aimed at identifying the most effective mitigation options based on the best scientific information. The process set out to determine what South Africa's risk-threshold should be, what contribution it could make to global efforts and how it could exploit opportunities presented by a global transition to a low-carbon economy. A wide range of stakeholders approved the LTMS document.

The University of Cape Town's Energy Research Centre co-ordinated four research teams that used energy and macroeconomic models to explore the consequences of various interventions aimed at reducing GHG emissions. The scenarios consider financial mechanisms to promote the development of climate-friendly goods and technologies, and instruments to encourage private-public partnerships. Through these scenarios, South Africa can begin to assess the economic implications of domestic emissions trading, the consequences of implementing a national carbon tax and the merits of other instruments for pricing carbon or incentivising low-carbon technologies.

Six policy pillars emerged. They included:

(i) GHG emissions reductions and limits;
(ii) analysis on strengthening current initiatives;
(iii) implementing the 'Business Unusual' call for action;
(iv) preparing for the future;
(v) adapting vulnerable sectors; and
(vi) co-ordinating national efforts.

Pillar 1

This commits government to a trajectory for emissions, starting with a peak between 2020 and 2025, then stabilising for a decade, before declining towards mid-century. Figure 6.1 was produced to illustrate outcomes arising from various approaches, ranging from business-as-usual to more stringent efforts. The scenarios conform to scientific requirements that limit global temperature increase to 2°C above pre-industrial levels.[39]

Pillar 2

This examines the existing emissions path and considers scaling up demand-side initiatives and interventions through regulation. For instance, government is considering tax incentives for cleaner technologies, such as the first renewable energy feed-in tariff (REFIT), and a carbon tax on electricity from non-renewable sources and fuel-inefficient vehicles. Other approaches under consideration are: focusing mitigation efforts on non-energy-intensive sections; setting targets for energy-intensive sectors; using economic instruments like domestic emissions trading; and refocusing industrial policy and investment strategy on low- and zero-carbon sectors. The LTMS process also considers subsidising transformational technology, creating markets for such changes, and mandatory requirements.

Among strategic options, a 'use the market' strategy was considered, and specifically the potential of 'increasing the price of carbon through an escalating CO_2 tax, or an alternative market mechanism'.[40] The National Treasury has also explored fiscal reform, including taxes for energy-related environmental issues. Trevor Manuel, the then Finance Minister, announced in his 2008 budget speech that options under scrutiny would include 'use of emission charges and tradable permits, tax incentives for cleaner production technologies and reform of the existing vehicle taxes to encourage fuel efficiency'.

Emission charges could certainly include a tax on carbon or fossil fuel emissions while tradable permits could apply to GHG emissions, or to measures for reducing emissions. A levy of 0.02c/kWh on electricity from non-renewable sources was introduced on 1 July 2009. Many observers saw this as South Africa's first carbon tax. Government is also considering introducing a carbon tax component in new vehicle sales in 2010.

Pillar 3

The LTMS has analysed the implications of deviating from a 'business-as-usual approach' while retaining growth and competitiveness. This pillar will focus on emission-intensive sectors that will need to meet national targets in the foreseeable future. The scenario attempts to balance objectives. For instance, Eskom and PetroSA[41] have announced new infrastructural developments that will be no different from the coal-fired power stations/petroleum refineries currently in use. And Sasol plans

an 80 000 barrel-a-day plant in Limpopo which will increase emissions significantly. The LTMS scenario analyses the economic implications of moving away from these conventional trajectories.

Pillars 4 and 5

Given the supply crisis and the need to continue investing in coal-based power, it does not seem government can meet its 2012 commitment to reduce coal for energy by 10%. It is considering innovative ways to expand energy infrastructure while including less carbon-intensive options. This pillar, while retaining coal at the centre of the mix, will inevitably consider increased renewable energy technologies and clean development energy.

South Africa needs to define incentives for investments in low-carbon technologies more clearly, thus making energy-efficient technologies and renewables economically feasible and attractive.

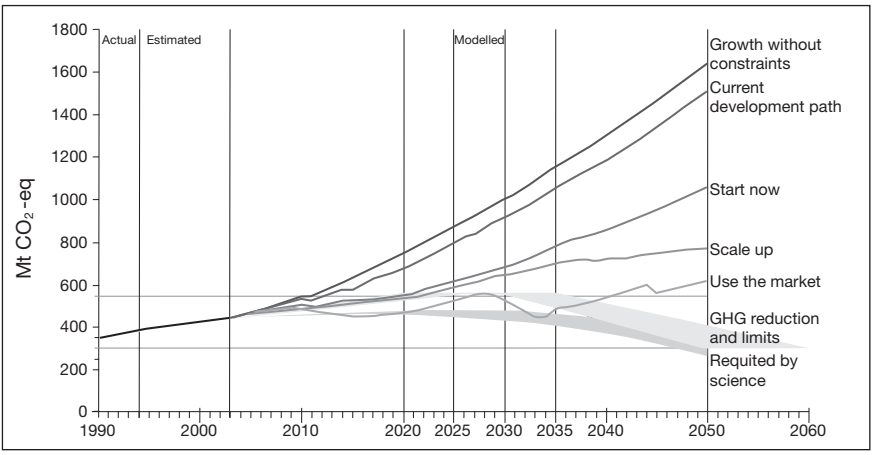
African leaders and businesspeople are largely unaware of the increasing monetary value of the global market for environmental goods and services. Its potential for job creation generally outperforms traditional energy and carbon-intensive industries. In Germany, for instance, a cloudy country, solar energy has created 40 000 jobs,[42] while wind farms are estimated to have created 70 000 jobs.[43] According to Laura Tyrer of the World Wildlife Fund (WWF), clean technology is positioned to become the fifth-largest contributor to job creation and investment in South Africa.[44] If the country's renewable energy sources reach 15% generating capacity, they will create 34 000 direct jobs by 2020. And producing 5 700 MW of solar photovoltaic power would create 680 jobs for plant workers and 8 800 construction jobs.[45]

To encourage investment in renewable energies, government must continue to emphasise the profitability and socio-economic benefits of the environmental industry, making the private sector more likely to fund development.

Pillar 6

This seeks to define the roles and responsibility of all climate and energy stakeholders to ensure co-ordinated action. Annexe 2 (South Africa's response to climate change: The role of key stakeholders) looks at key actors and their various roles.

Figure 6.1: Peak, plateau and decline LTMS, 1990–2060



Source: Long-term scenarios for South Africa. Scenario Building Team (2007)

Challenges and opportunities in carbon mitigation

The LTMS process concluded that South Africa's main carbon mitigation options lie in the energy sector, particularly in shifting away from coal.[46] The country, with some of the best natural resources in the world, has committed to a target of 10 000 gigawatt hours (GWh) of electricity from renewable energy resources by 2013 — essentially 5% of the electricity mix. This commitment was included in the (then) Department of Minerals and Energy (DME)'s 2003 White Paper.[47] The South African government is working towards achieving this target while providing affordable access to energy throughout the country and removing barriers to renewable energy penetration. Critics charge that government has achieved only a small portion of its initial target after six years — and that the goal was less than ambitious anyway. If the target were to be achieved by 2013, it is estimated that it will generate more than 35 000 jobs, add ZAR 5 billion to GDP and ZAR 687 million to the income of poor households.[48]

At a national renewable energy summit from 19–20 March 2009 in Pretoria, the energy minister indicated that more ambitious targets for 2013–18 should be set, starting at 6–9% and rising to 9–15% of South Africa's energy mix.[49] By pursuing a higher target, most likely dominated by large-scale rollout of concentrating solar power, South Africa's GHG emissions may (if other mitigation action is pursued) peak and

then stabilise by 2025. As part of this strategy, the National Electricity Regulator of South Africa approved the first REFIT scheme in March 2009. This obliges Eskom to buy power from licensed renewable energy generators at predetermined prices, the cost to be passed on to Eskom customers. Wind, small hydro, landfill gas and solar power technologies are covered under REFIT. Other technologies will be considered in the next six months,[50] but tidal and geothermal technologies are currently excluded as being not yet commercially available. Tariffs approved include the following: for wind (ZAR 1.25/kWh); small-scale hydro (94c/kWh); landfill gas (90c/kWh); and concentrated solar (ZAR 2.10/kWh).[51]

However, although a welcomed initiative, REFIT is currently only a guideline and no legislation has been provided as of yet.

South Africa also has other subsidy/incentive schemes in place. Eskom offers a direct rebate on solar heaters ranging from ZAR 1,900 to ZAR 4,900 depending on type. It is also investigating subsidies for windmills and wind turbines.[52] Estimates are that wind turbines could contribute up to 1% of South Africa's electricity needs.[53] Subsidies are imperative, as South Africa currently imports solar heaters and wind turbines from China at an additional cost, making them unaffordable to local citizens.

South Africa's national response

According to environmental experts, South Africa needs an all-inclusive approach to address energy needs while ensuring environmental sustainability. To date, South Africa has been very slow to develop non-fossil fuel alternatives, mainly due to cheap electricity.

South Africa should broaden its energy mix to balance the advantages and pitfalls of each resource. There is no single solution and some renewable energy options are more suitable than others. South Africa, for example, has about a quarter of the world's best sunlight of all land masses (around 25% of the highest category of insulation, i.e. solar power potential),[54] and its wind power potential on the west coast is also enormous.

However, there are disadvantages to renewable options as they can be intermittent and may only be viable as a support mechanism to a larger coal or nuclear powered grid. They are also relatively expensive and will remain so until there are attractive market incentives to encourage their local production and dissemination.

Energy option 1: Nuclear

In 2007, 14% of the world's electricity came from nuclear power. South Africa has also been exploring this avenue internationally as a means to reduce its current shortfall in base load supply. Supporters of nuclear energy highlight its predictability over other renewable energy resources and point out that uranium is cost-effective and abundant in South Africa, meaning lower costs for consumers.

However, environmental agencies have raised valid concerns. The WWF, for example, does not consider nuclear power viable because of its enormous costs, the long timeframe for the construction of plants, radiotoxic emissions, waste-disposal problems, future shortages of uranium, safety issues and proliferation impacts. Other critics are concerned about nuclear weapons proliferation[55] and the added costs of uranium enrichment, fuel fabrication, transport and security. Environmental expert, David Fig, says the claims that nuclear energy is carbon friendly are not accurate. During the generating cycle, about 40 grams of CO_2 per kilowatt of electricity are emitted.[56]

Costs are a legitimate concern. Eskom's board decided on 5 December 2008 not to proceed with a second nuclear plant because of the cost. (Three planned plants would have taken up almost the entire Eskom budget of ZAR 1.3 trillion to 2025.) Koeberg remains the first and only nuclear power station in South Africa, with a generating capacity of 1 800 MW.

It is an important strategic choice. This money could fund alternative energy resources, such as the entire Inga III 4 500 MW hydroelectric scheme, 3 000 MW of wind power, 1 600 MW of solar thermal concentrator with salt storage, 5 000 MW of capacity displacement by solar water heaters, and still leave a few billion rands in change to upgrade the distribution network. Ultimately it is a national choice — but the hope is that the decision will be driven by economic and sustainable development concerns and not political ones.

A deliberate silence hangs over the Pebble Bed Modular Reactor, which has already cost taxpayers more than ZAR 16 billion (some estimates claim ZAR 32 billion), and the nuclear industry's stated intention to re-launch the Pelindaba uranium enrichment plant and 'reprocess' radioactive waste from elsewhere to fund nuclear projects.[57]

Energy option 2: Coal with efficient technology

Electricity demand is increasing at a rate of 1 000 MW a year. While there is increasing pressure for non-fossil fuels, abundant reserves and low costs make coal a preferred source for the foreseeable future. The challenge is to enhance efficiency and environmental acceptability through clean coal technologies. According to the Council for Scientific and Industrial Research (CSIR), a process called integrated gasification combined cycle could be applied. It would be more efficient, reduce water consumption and could co-produce liquid and gaseous fuels and chemicals.

Efficient housing and buildings

Buildings account for 35–45% of global energy usage, according to Professor Lars Nilsson of Lund University. Thermal efficiency in basic subsidy houses can improve the welfare of the urban poor and set a cleaner development trajectory.[58] This can be done relatively cheaply through proper insulation and the use of solar water heaters. Challenges include lack of funding, poor governance capacity at all levels, insufficient knowledge of the benefits and lack of skills.

Fuel efficiency and standards

'International fuel standards and emission requirements are continually being tightened up, and with the requirement for cleaner emissions come technological advancement in engine design', explains Johan van Zyl, president of Toyota South Africa and president of the National Association of Automobile Manufacturers. 'With these cleaner-burning engines comes an associated benefit in reduced fuel consumption'. Van Zyl says that improvements in the quality of South African fuel are imperative. Vehicle manufacturers and distributors need to offer reduced fuel consumption and environment-friendly vehicles.[59]

Building vehicles for export meant conforming to international clean fuel requirements but this was compromised by a lack of latest-generation fuels at home and a shortage of global resources to enable refinery changes.

Introducing better efficiency in coal technology, housing and transport would help the economy and bring climate benefits. But those changes needed to be accompanied by technology to store CO_2.

Government is investigating other long-term solutions like changing the fuel mix (as in Brazil) and moving to a low-carbon economy. In the

short term, energy efficiency provides potential for mitigation — and for energy savings. Because the minerals–energy complex is central to the South African economy, it could take decades to change the fuel mix dramatically.[60]

South Africa has numerous policies currently in place to promote sustainable energy and energy efficiency, the most important of which include a White Paper on Energy Policy (1998); a White Paper on Renewable Energy (2003); an Energy Efficiency Strategy (2005); and a Biofuels Industrial Strategy (2007). See Annexe 3 for a list of sectoral programmes currently in operation.

Energy option 3: Carbon capture and storage

Carbon capture and storage (CCS) technologies are designed to reduce fossil-fuel emissions by storing carbon dioxide rather than releasing it into the atmosphere. Tony Surridge of the South African National Energy Research Institute said that the technology is so important that he 'wishes to see a government decision to ensure that all new coal power stations should be CCS ready'. He also reported on the establishment of the South African Centre for CCS in March 2009, which aims to implement a CCS demonstration plant by 2020. He said the centre was currently focusing on developing a CCS atlas to locate potential sites and aims to complete a test injection site by 2016. Given that poverty eradication and job creation were primary concerns, CCS has to be balanced with development priorities.[61]

South Africa agreed that the viability of CCS 'should be appropriately recognised' as a key mitigation strategy and that there was a need to 'accelerate deployment globally and particularly in developing countries'.

But CCS is expensive and the technology has limited storage capacity (only about 10% of all emissions). In addition, it has not yet been implemented on a large scale and the environmental impacts of storing CO_2 underground need to be fully researched. The process also does not deter bad practice by polluting companies as it does not contribute to decreasing net CO_2 emissions. CCS is an interim approach to be used with technologies that reduce emissions.

South Africa in international climate change negotiations

South Africa's LTMS process provides a basis for a broadly supported, robust policy. It is widely recognised as innovative and appropriate.

The South African climate change summit in Midrand in March 2009[62] also saw the adoption of an ambitious National Climate Framework, incorporating government's vision, individual responsibilities of key ministries, a strategic framework and a timetable for action. This framework, Draft Zero, will underpin future policy decisions and will be used to inform its international negotiating position.[63] After further consultation at national level, these discussions will be translated into a National Climate Change Response White Paper published in the gazette in the first quarter of 2010 and then a Green Paper towards the end of 2010. By 2012, it is hoped that policy will be translated into national law.

Despite these key developments at the national level, there is a growing urgency for domestic policy to align with international positioning. According to Worthington, 'for us to walk the talk, we need to start implementing our policy commitments'.[64] Statements emanating from a cabinet meeting on 9 September 2009 are worrying. A spokesperson said that 'while South Africa acknowledges that it is a contributor to the overall global GHG due to its reliance on coal-powered electricity, we are committed to taking responsible action to reduce our emissions, but we are not ready to agree to any targets that would undermine our growth trajectory'.[65]

However, 'developing countries have a substantial role to play in GHG emission reductions, as future emissions are likely to be dominated by the growth in developing countries', highlights Professor Harald Winkler of South Africa's Energy Research Centre.[66] In current climate change negotiations there is increasing pressure on non-Annexe 1[67] polluters to initiate their own mitigation strategies and to participate in climate change regimes. But given the challenges faced by all developing countries, any additional constraint on growth creates a further burden.

The country has also been active and constructive in the international debate, sometimes leading by example. According to Richard Worthington, WWF's climate change manager, 'South Africa has been playing a significant role ... being the first country to openly contemplate international commitments to mitigation' and has initiated the concept of nationally appropriate mitigation actions that are measurable, reportable and verifiable.[68] It has developed a respected reputation and is known as an advocate of the developing world and a supporter of climate justice.

South Africa ratified the UNFCCC in 1997 and acceded to the Kyoto Protocol in 2002.[69] It has played (and is playing) a leading role in the

Africa Group at the UNFCCC negotiations, insisting on more funding for adapting to climate-related impacts. It is a vocal member of the G77+China Group, pushing for 'climate equity' and 'climate justice'.[70] For example, Van Schalkwyk referred to the injustice of adaptation: 'While developing countries join the dinner late, only in time for the dessert, they are still expected to foot the bill for everyone's three-course meal'. He called on the international community to increase its funding urgently, especially to Africa. In this view contributions to the Adaptation Fund should be in addition to already agreed assistance and the fund should be transparently governed with equal board representation. South Africa's negotiating team is also vocal on building capacity, transferring technology and increasing funding for cleaner technologies.

In March 2009, South Africa's then Minister of Environment and Tourism criticised developed economies, particularly the US, for stalling negotiations. He said the industrialised North needed to allow developing economies to grow: 'Countries responsible for historical emissions should bear the brunt of the mitigation obligations, and emission reductions should be based on the Intergovernmental Panel on Climate Change's most ambitious scenarios'. South Africa suggested that Annexe I countries reduce 1990 emissions by at least 40% by 2020 and by at least 80% by 2050. Minister Van Schalkwyk also spoke about a post-Kyoto regime with comparable targets and binding compliance, recognising the importance of incentives. He emphasised that developing countries should accept their share of responsibility, albeit in a differentiated way.

Each emerging economy should seek to lead in areas where it has competitive advantage and expertise. South Africa, for example, should take the lead on mineral processing, refineries and metal production; China on energy-efficient goods and renewable technologies; India on the services sector; and Brazil on land use and forestry. These developing countries could exchange knowledge and co-operate on these sectors. For example, India has adopted efficient super-critical technology in four plants under construction. This technology would be very useful to assist South Africa in moving towards energy efficiency targets in its coal-fired plants.

At UNFCCC meetings in Bangkok (28 September to 9 October 2009) and Barcelona (2–6 November 2009), developed countries suggested a 'common responsibility framework for mitigation' that would result in the demise of the Kyoto Protocol and the loss of distinction between the commitments of developed and developing countries.[71] In the recent

Copenhagen negotiations, South Africa was again adamant that the status quo must remain, namely the two-track negotiating approach.

'We will not be politically pressurised into accepting a weak outcome that re-interprets the Convention and the Bali Action Plan to the disadvantage of developing countries. We would rather work from within the Africa group to seek a suspension of the proceedings and additional negotiating time, with a negotiating mandate that reflects the two-track approach. We cannot accept the demise of the Kyoto Protocol — we cannot turn the clock back on more than a decade of progress in building the international climate regime', affirmed Minister for Environment Buyelwa Sonjica.[72] She emphasised that the Kyoto track is important for South Africa and Africa as it recognises adaptation and provides market mechanisms to accelerate the transfer of technology and revenues.

South Africa was president of the Bureau of the African Ministerial Conference on the Environment from June 2008 to June 2009.[73] At its conference in Johannesburg, in June 2009, Van Schalkwyk called for 'an African Road Map for climate negotiations' and for serious commitment to the Bali Strategic Plan for technology support and capacity building. Although other countries in the region do not face the same political pressure for mitigation reductions, South Africa identifies with their adaptation needs and places regional concerns as an important foreign policy priority. It is very aware of its regional image and therefore acts as an advocate for the region and for the continent. It brings a well-qualified negotiating team to push the North for more financial and technical commitments.

Developing country alliances seems a functional way for South Africa to achieve national goals. It believes that developing countries should forge a common position to resolve key problems, such as ensuring that a greater financial burden is borne by industrialised northern countries that have historically high emissions, as well as to place heightened political pressure on countries like the US, Canada, Japan and Australia to make further mitigation commitments. The BASIC alliance emerged as a powerful negotiating force in the Copenhagen talks. South Africa, along with its southern partners, China, Brazil and India, sought to protect the interests of fast-developing nations responsible for a growing percentage of the world's emissions. The group helped broker an agreement that has come to be known as the Copenhagen Accord, though South Africa did express disappointment in the deal. This Accord shows the commitment

of 28 nations to reduce emissions and to make their reduction efforts subject to international review.[74]

Besides its role in BASIC and the African Group, South Africa is also an important member of the India–Brazil–South Africa forum on energy and climate change and the G5/outreach grouping.[75] It also plays an active role in the Major Economies Forum on Energy and Climate (MEF)[76] and within the G20.[77]

Conclusion

South Africa is by far the largest emitter of GHGs in Africa with the majority of its emissions originating from the energy sector, a key facet of its economic structure, and from two companies in particular, Sasol and Eskom. At present cheap but dirty electricity gives it a competitive advantage with energy-intensive sectors.

However, the country's large carbon footprint, particularly per capita, means that the international community calls on it to demonstrate responsible behaviour for the common good. As a large developing country, it will no longer be exempt from compulsory mitigation commitments under a post-Kyoto regime. Approaching future negotiations, it needs to consider innovative ways to retain economic growth and competitive advantage — without jeopardising the environment that this development is based on. This can be done by taking advantage of its natural resources (particularly solar and wind) and investing in the research and dissemination of these green technologies.

To reduce carbon emissions, its conventional fossil-fuel energy path must be altered towards a greater use of renewable energies. While the government has shown willingness to comply with international regimes, stakeholders such as Eskom and Sasol will have to be put under increasing pressure. Does the Department of Water and Environmental Affairs (DWE) have the political clout to do so? Is this a priority of the Zuma administration? Can it be done without jeopardising economic growth? Are the actors involved willing to change their industrial strategies? Is government willing to accept binding commitments?

A commitment to a mitigation target at Copenhagen would require the country to overhaul its energy system and gear itself for using renewable resources. This would mean a drastic shift in energy policy — but it would also stimulate certain sectors. Studies have shown that it is possible to produce 50% of all electricity from renewable resources by 2050, and

that this would generate up to 100 000 new jobs.[78] Green technologies also have the advantage of producing energy off the national grid.

'Free markets alone cannot achieve the immense progress required', warns Jeffrey Sachs, Special Advisor to UN Secretary-General Ban Ki-moon on Millennium Development Goals.[79] He said: 'None of this, by its nature, can be done by markets alone. We need research, development, demonstration, public knowledge, testing and monitoring'. No private company would profitably develop these technologies on their own. 'Large-scale technical systems require clever policies and public–private partnerships.' The South African government would have to stimulate innovation in delivering technical solutions for housing needs, and develop local industries to meet these needs.

South Africa is playing a positive role in climate change negotiations internationally, and has clearly committed itself to a binding multilateral agreement that honours the principles and intent of the UNFCCC. But it also remains dedicated to the developing world, pushing for climate equity and mobilising additional resources for climate change adaptation.

Its approach to the climate challenge at the international level is driven by important domestic realities, both political and economic. Its participation at the UNFCCC is thus informed by the possibilities and limitations revealed in the LTMS process, which has identified the compromises that may be required and the mitigation commitments it might undertake in sectors, such as energy and power generation. With its emphasis on national concerns and priorities, and a range of political and economic realities on the ground, a lack of commitments at the international level from the big polluters could provide South Africa with the excuse it needs to renege on GHG reduction commitments.

At national level, however, existing policies (for example, on renewable energy technology and energy efficiency) have not been implemented sufficiently. There seems a large gap between written policy (such as REFIT) and wide-spread implementation, and an absence of indicators to measure progress. South Africa's international negotiating position must be consistent in complementing domestic initiatives. It lacks a national policy that accelerates the demonstration, development and deployment of low-emission energy technologies, including renewable energy sources, smart-grid systems and energy storage. It needs to do the following: refurbish power-generating facilities and co-generation; improve sustainable mobility and the use of low-emission transport

vehicles; and advance the demonstration of CCS and nuclear energy.

Reconciling energy–climate challenges with global climate responsibilities will not be an easy task for South Africa. Transition to a new energy mix requires a combination of approaches from government. These include policy instruments and legal tools to encourage investment in renewable energy technology, to facilitate their deployment into the market, and to coordinate approaches in other domains to drive this transition. For South Africa to achieve this goal, all key stakeholders need to be fully involved and the government needs to play a strict role to ensure co-ordination among key actors and to encourage a shift in the public mindset.

Annexe 1: South Africa's energy sources

Coal	72%
Oil	12%
Biomass/waste	10%
Gas	3%
Hydro	0.24%
Nuclear	2%
Solar/wind/others	0.07%
Geothermal	0%

Source: Allianz & WWF (World Wildlife Fund for Nature), G8 Climate Scorecards 2009, July 2009

Annexe 2: South Africa's response to climate change: The role of key stakeholders (with reference to Pillar 6 of the LTMS)

National government: The Department of Water and Environmental Affairs (DWE) is responsible for implementing UNFCCC commitments. This ministry is led by Minister Buyelwa Sonjica and has recently split from the Department of Environment and Tourism, led by Minister Marthinus van Schalkwyk. Other key ministries (to name but a few) are Science and Technology, Energy, Transport, Finance, International Relations and Co-operation (DIRCO),[80] Trade and Industry (DTI), and Public Enterprises. Due to its cross-cutting nature, climate change should be mainstreamed through all national policies. The new National Planning Commission, led by Minister Trevor Manuel, could play a key role in co-ordinating climate policies. An Inter-Ministerial Committee will direct the formulation of a national programme and develop a final mandate for the UNFCCC. It consists of the Ministers of Water and Environmental Affairs, DIRCO, Economic Development, DTI, Rural Development and Co-operative Governance and Traditional Affairs. Government will ensure the mandate includes alleviating poverty and economic growth. Government is pushing for an inclusive approach and wants to consult at all levels.
Municipalities and local government: According to Professor Coleen Vogel, South African cities are developing urbanisation and transportation strategies with local government and municipalities. Cape Town adopted an energy and climate change strategy in August 2006. Durban, Johannesburg and Ekurhuleni are in the process of doing so.[81]

(cont.)

Technical expertise: South Africa has remarkable scientific strengths. In co-operation with the Department of Science and Technology, the CSIR has developed a model to predict global climate change. Universities (Witwatersrand, Stellenbosch, Cape Town and Pretoria) are researching aspects of climate and energy. Essential data to inform climate decisions is being assembled.
Non-governmental agencies and organisations: Organisations like the WWF, University of Cape Town's Energy Research Centre, Earthlife, Oxfam and others play important roles, including analysing scientific data, doing impact assessments, providing oversight and raising awareness. They also analyse scientific data to aid policymaking. Civil society exerts pressure by calling for restraints on fossil fuels and the building of coal-fired plants. They want energy efficiency to be mandatory in government-built homes by 2015 and for one million solar water heaters to be installed by 2020.
South African businesses: Participation to date has been limited to voluntary agreements — the Energy Efficiency Accord and the Carbon Disclosure Project. The 2005 Energy Efficiency Accord includes 32 large companies, including Eskom, which have committed themselves to government energy targets. Of those, 19 of them account for about 24% of national electricity consumption. The Accord now has 50 signatories and encourages peer involvement and policy engagement.[82]
Financial institutions and private entities: The UNFCCC estimates that more than 80% of the investment required for climate change will have to be privately financed.[83] Financial institutions — especially like the African Development Bank and the Development Bank of Southern Africa — are essential. In October 2009, the World Bank endorsed a Clean Technology Fund of US$500 million to help South Africa achieve its 4% renewable energy goal by 2013, improve its energy efficiency by 12% by 2015, and provide one million households with solar water heating over the next five years.
Local communities: Communities vulnerable to the impacts of climate change need to be involved in decision-making. Their indigenous knowledge is crucial and their requirements need to be understood.
South Africa's National Climate Change Committee and the UNFCCC negotiating team represent various stakeholders. The team attending the Copenhagen negotiations in December 2009 included key ministry officials, academic institutions, Eskom, a legal advisor and a range of experts.

Annexe 3: Sectoral climate policies in South Africa

• **Electricity***:* Energy-efficiency strategy for energy-production sectors; legal and economic framework development for future substitution of coal-based fuel by natural gas, for example, the Gas Act.
• **Households and services***:* Energy-efficiency standards for buildings and appliances; appliance labelling; compact fluorescent lamps programme.
• **Industry***:* Energy-efficiency accord, including targets for 32 large companies.
• **Transport***:* Support for the production of efficient motors; 0.02c/kWh levy on non-renewable electricity and a carbon tax component in new vehicle sales; planned promotion of public transport; expansion of solar traffic lights.
• **Renewables***:* Target: capital subsidies for renewable energy technologies; white paper on RE and energy policy; off-grid photovoltaic electrification programme; feed-in tariff; planned new targets for RE sources.

Source: Allianz & WWF, *op. cit.*, 'South Africa', p. 46

Endnotes

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4 Statistics vary on South Africa's contribution to overall GHG emissions. World Resource Institute quotes 1.1% and the UNDP quotes 1.5%.
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6 India and China do not have a high rate of emissions per capita. For this reason they both support the principle of 'equal per-capita basis with accounting for historical responsibility' in international negotiations.
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23 IEA (International Energy Agency), 'IEA energy statistics: Energy indicators

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27 'The Republic of South Africa'. Renewable energy and energy efficiency partnership. Imbewu Sustainability Legal Specialists (Pty) Ltd. 2009

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29 The Cahora Bassa HVDC transmission provides an important facility to the South African grid. It transmits 1 920 MW of power from a generating station on the Zambezi River. The original transmission was put into service in three stages from 1977 to 1979. The system includes two converter stations, one at Songo in Mozambique and the other at Apollo in South Africa. The transmission is owned by Hidroelectrica De Cahora Bassa in Mozambique and Eskom in South Africa.

30 The first phase of the scheme will be the construction of the Inga III hydroelectric plant, expected to generate about 5 000 MW of electricity. It is expected to provide electricity to five countries by 2015. Western Power Corridor (Westcor), the holding company, is equally owned by the electricity utilities of South Africa, Namibia, the Democratic Republic of Congo, Angola and Botswana.

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