

Market opportunities in environmental goods and services, renewable energy, carbon finance and CATs

Country report: South Africa

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Contents

Summary of market opportunities in environmental goods and services, renewable energy, carbon finance and CATs in South Africa	1
1: Introducing the South African market	3
2: The market for environmental goods and services in South Africa	6
3: The market for carbon abatement technologies, renewable energy and carbon finance in South Africa	9
4: Policy and regulatory frameworks	14
Annex A: Definitions of environmental goods and services, renewable energy, carbon finance and CATs	19
Annex B: Power stations in South Africa	22
Annex C: Bibliography	23

This report is one of seven on the opportunities for exports to, and direct investment and joint ventures in, the markets for environmental goods and services (EGS), carbon abatement technologies (CATs), renewable energy and carbon finance in selected countries (see Annex A for definitions of these sectors). It should be noted that the nuclear sector was excluded from the review. The other countries are Australia, Brazil, China, India, Turkey and the USA – representing a mix of emerging/high growth and developed overseas markets in these sectors.

The findings from the reports have been fed into an overview report which:

- provides an assessment of the UK's competitive advantage in EGS, CATs, renewable energy and carbon finance,
- maps this onto the market opportunities as revealed from the case studies, and
- suggests the opportunities for UK exporters and direct investors by market and sector.

The report considers the general market opportunities presented in the selected countries. It is based on desk research that drew on the most readily available and accessible information sourced from within the country concerned and from international agencies.

It provides background designed to be helpful in focusing the more detailed investigations that will need to be carried out by anyone interested in selling to or investing in the relevant markets and countries.

The report does not assess specific opportunities for UK exporters and/or investors – or their appropriate route to market. However, it shows where there are significant market opportunities in environmental goods and services, renewable energy, carbon finance and CATs.

Summary of market opportunities in environmental goods and services, renewable energy, carbon finance and CATs

Opportunities

- 1 There are significant opportunities in South Africa for exports and/or direct investment in hazardous waste management, solid waste management, water and wastewater treatment, as well as in advanced conventional energy generation and renewable energy. There are future opportunities in air pollution control, cleaner technologies, generation technologies and asset management. A map of current and future opportunities in the environmental and low carbon markets in South Africa is set out below.

Sector	Current opportunities*	Future opportunities	Policy framework (current)
Environmental Goods and Services			
Air pollution & control	☹️	😊	Fair/Good
Cleaner technologies			
Energy management	😊	😊	Good
Environmental consultancy	😊	😊	Good
Environmental monitoring			
Marine pollution	☹️	😊	Fair
Noise & vibration			
Land remediation			
Waste management	😊	😊	Good
Water supply	😊	😊	Fair/Good
EGS overall	😊	😊	Fair/Good
Carbon Abatement Technologies (CAT)			
CCS	☹️	😊	Poor
Generation technologies	☹️	😊	
Low carbon fuels	😊	😊	Fair
Asset management			
CAT overall	☹️	😊	Fair
Other opportunities			
Renewable energy	☹️	😊	Fair
Carbon finance	😊	😊	

Key	😊	Text
	😊	Relatively large market size and activity, relatively demanding regulation, relatively high public expenditure in this sector and relatively liberal trade and investment regime
	😊	Mix of modest market size and activity, modestly demanding regulation, modest public expenditure and liberalising but still restrictive trade and investment
	☹️	No or minimal market size and activity, no regulation, and restrictive trade and investment regime
		No or inadequate information

* The assessment of current opportunities is based on the most recent official data and information on market size and sector activity. In many cases this can refer to 2005 figures and as such certain conclusions in this report may not capture very recent developments in some sectors or announcements concerning the near future. A variety of sources, methods and time-frames was drawn on to assess future opportunities – covering the next five-ten years based on government policies and/or budget allocations and/or independent forecasts and projections.

Market entry options

- 2 Most of the provisions of the EU/South Africa Trade, Co-operation and Development Agreement came into force on 1 January 2000. The Agreement has boosted South Africa's trading prospects with Europe. Liberalisation towards a free trade area over the 12-year transition period will strengthen the UK's commercial position in South Africa. The UK is the second largest European trader with South Africa (after Germany). The availability of possible market entry strategies is summarised below:

Route to market	Availability	Comment
Export	•	Trade liberalisation followed
Foreign direct investment (FDI)	•	The rate of FDI is the highest across Africa, and reaches a variety of sectors notably energy, machinery and mining
Joint venture (JV)	•	Joint venture is a possibility with South African firms, although firms must be aware of bbBBE ¹ regulations

Source: SQW Consulting

Gaps in the evidence base

- 3 A thorough trawl of readily available reports, studies and policy statements with regard to the markets under review and consultations with stakeholders found little evidence on the opportunities in South Africa in the following markets:
- Cleaner technologies (EGS)
 - Environmental monitoring (EGS)
 - Noise and vibration (EGS)
 - Land remediation (EGS)
 - Asset management (CATs)
- 4 This is not to say that this evidence is unavailable. More information could undoubtedly be found on specific market opportunities and constraints from specialised and technical policy statements/guidance, journals and trade press. However, it was beyond the terms of reference for this review to investigate the opportunities in this degree of detail.
- 5 The report should be read as an introduction to the most significant opportunities in the Turkish markets. It has been designed to provide a focus for the more detailed investigations that will need to be carried out by anyone interested in selling to or investing in the markets.

¹ Broad based Black Economic Empowerment strategy introduced by Government in March 2003

1: Introducing the South African market

This section provides background information on the South African economy and the drivers and international legal dispositions affecting the growth of the market for environmental and low carbon technologies, goods and services.

Key facts

- 1.1 South Africa is Africa's largest economy (GDP in 2006 was US\$255 billion) but has one of the most unequal distributions of income in the world. The dominant sources of economic activity are centred around minerals, energy and services (advanced financial services, tourism and retail). Whilst prospects for the economy continue to improve as a result of the gains in macroeconomic stability, growth efforts are constrained by massive unemployment, low savings levels and an inflexible labour market. To address some of these issues, in March 2003, the African National Congress (ANC) Government introduced a broad based Black Economic Empowerment strategy (bbBEE), which aims to accelerate growth and stimulate job creation.

SOUTH AFRICA – KEY FACTS (2000-2006)

	2000	2001	2002	2003	2004	2005	2006
GDP growth (annual % at constant 2000 prices)	4.2	2.7	3.7	3.1	4.9	5.0	5.4
Gross capital formation (% GDP)	16	15	16	17	18	18	20
CO ₂ emissions (metric tonnes per capita)	9	9	9	9	9	—	—
Total debt service (% of exports of goods, services and income)	10	11	12	6	4	5	7
GDP per unit of energy use (constant 2005 PPP US\$ per kg of oil equivalent)	3	3	3	3	3	3	—
Trade (% of GDP)	53	56	62	54	54	56	63

Source: World Bank Group Millennium Development Goals statistics, Statistics South Africa

- 1.2 South Africa is expected to continue to benefit from strong foreign direct investment (FDI) inflows, which remain the highest of any state in Sub-Saharan Africa (reaching US\$6.4 billion in 2005). According to Unctad's World Investment Report 2006, investment inflows to South Africa were the most diversified in Africa in 2005, being channelled into banking, energy, machinery and mining, with banking receiving the largest share.
- 1.3 UK investment flows to South Africa have grown over recent years, with UK net outward FDI figures to South Africa of £2,265 million (2002), £2,222 million (2003), £3,840 million (2004), £5,716 million (2005); net book value of UK direct investment at the end of 2006 was £8,630 million.
- 1.4 The current regime inherited an economic system based on import substitution, high tariffs and subsidies, and extensive government intervention in the economy. Trade liberalisation has progressed substantially over the last decade; the country has reduced its import-weighted average tariff rate from more than 20 per cent in 1994 to 7 per cent in 2002, and has removed the requirement for permits on most imports, except on used products and those regulated by international treaties.
- 1.5 Trade and investment with the UK is important, and is viewed positively within South Africa, with a number of ANC leaders having received a UK education whilst in exile during apartheid. English is only one of 11 official languages but is the medium of communication in most government departments and publications. The UK is South Africa's largest trade and investment partner with over £7 billion in two-way trade in goods and services and £24 billion of UK investment in South Africa. Exports from the UK to South Africa in 2007 included £129 million of specialised industrial machinery, and £120 million of power generating machinery.

Drivers of environmental goods and services, renewable energy, carbon finance and CATs

- 1.6 South Africa has a population of just over 47 million (2006), with a recent average annual growth rate of 1.7 per cent (1990-2006). Typical of an industrialising (or 'advanced developing') economy, South Africa is characterised by rapid levels of population growth and urbanisation (currently around 60 per cent live in urban areas), coupled with deforestation and increasing natural resource exploitation. Like China and India, it is poor but growing, and faces a rapidly rising demand for energy, in particular, electricity.
- 1.7 It is a resource-rich country. It has an abundance of minerals and is the top global exporter of platinum, manganese, vanadium and chromium, and holds 40 per cent of the world's gold reserves in the Witwatersrand area. Other main mineral raw materials include diamonds, uranium, iron ore and coal. It is also rich in biodiversity and natural resources, with three internationally recognised biodiversity hotspots and home to nearly 10 per cent of the world's plants, 7 per cent of the world's vertebrate species and 5 per cent of the world's known insect species, as well as 15 per cent of global marine species.
- 1.8 Attitudes towards the environment – particularly climate change – are shifting, and there is now growing awareness of environmental issues. The country has witnessed an increased level of lobbying for stricter environmental protection laws, from both domestic and international environmental groups, since the country's first democratic election in 1994. However, whilst the country faces mounting pressure to provide access to clean drinking water and improved air quality, rapid industrialisation and manufacturing for export will continue to be encouraged as a strong economic driver for growth. The growing share of energy intensive industries in South Africa's economy, and the country's reliance on coal, have led to high and rising carbon emissions.
- 1.9 The vast majority of South Africa's electricity (80-90 per cent) is generated in coal-fired power stations by Eskom (Energy Supply Commission, a public utility founded in 1923). Coal-fired power generation is based on the ready availability of cheap coal mining. However, despite large year-on-year jumps in peak demand, there has been little investment in expanding capacity, and this has now led to a situation of peak shortages and – consequently – a rolling schedule of planned electricity cuts across the country. The country has been warned to expect 'tight energy supply' for at least another four years.
- 1.10 Without any large-scale planned additions to generation capacity, this will place restrictions on large-scale energy-consuming projects (such as Rio Tinto Alcan's planned Coeca aluminium smelter). The case for expansion of renewable energy is therefore compelling, and the government's commitment to the diversification of South Africa's energy supply – as well as the provision of energy to (off-grid) remote rural areas – will create an 'enabling' environment for the introduction of independent power producers using renewable energies.

International legal dispositions

- 1.11 South Africa is party to more than forty international environmental treaties, although its status as a ‘developing country’ means that it is not required to actively reduce greenhouse gas (GHG) emissions under the Kyoto Protocol. South Africa’s status against a number of key international legal dispositions is presented in the table below:

Table 1-1: South Africa’s status against major International legal dispositions

International convention	South Africa’s status
UN Framework Convention on Climate Change	Ratified (1997)
Kyoto Protocol	Ratified – acceded as party in July 2002
Ramsar Convention	Ratified
Vienna Convention	Ratified (1990)
Montreal Protocol	Ratified (1990)
Convention on Biological Diversity	Ratified (1995)

Source: SQW Consulting

2: The market for environmental goods and services in South Africa

This section describes the growth market for environmental goods and services (EGS) in South Africa and outlines the drivers of this growth. It then provides more information on those segments presenting significant market opportunities.

2.1 The South African Department of Trade and Industry (DTI) and industry stakeholders completed a study in 2006 to investigate the domestic environmental goods and services (EGS) sector. The study estimated the size of the South African EGS market to be between ZAR 14.6 billion (US\$1.8 billion)² and ZAR 23.2 billion (US\$2.9 billion) in 2004 (1-1.6 per cent of GDP). One problem, however, is a lack of reliable statistics on the sector. Another is the lack of cohesion and organisation within the sector. However, this does not seem to be getting in the way of its growth prospects with the South African DTI estimating that the industry is currently experiencing an annual growth rate of between 10 and 15 per cent.

2.2 EGS News (December 2007) summarised the findings of the DTI study as follows:

The major SA EGS sub-sectors were focused on water and waste management and resource management. Demand-driven growth is experienced in the climate change, air and noise pollution goods and services. South Africa is a world leader in specific niche areas such as the management of mine waste and mine rehabilitation and conservation and biodiversity management.

The structure of the South African EGS industry includes a strong presence of foreign subsidiaries, established small local companies and new and emerging players. The current focus of these companies is the local market, which is therefore extremely competitive.

Key growth areas

- 2.3 South Africa's rapidly growing demand for energy, and the growing share of energy intensive industries in its economy has led to an increasing need for sustainable energy management, both in policy and practice.
- 2.4 The two major types of pollution in South Africa are marine and air pollution. South African cities do not have levels of pollution being experienced by many in India or China (Mastercard's Insights Reports on Urbanisation and Environmental Challenges, 2008). But pollutant levels are still high – NO₂ levels in Cape Town were measured at significantly higher than Calcutta, for example. In addition to industrial pollution, low-level atmospheric pollution results from coal-heated boilers (eg in hospitals) or coal combustion in stoves.
- 2.5 Historically, air and water pollution has not been well regulated. There is still considered to be a significant apartheid legacy in terms of the distribution of impacts of pollution within the country, which was concentrated disproportionately on black communities. Apartheid spatial planning sited crowded townships in close proximity to toxic waste sites, sewerage treatment plants, or downwind/downstream from industrial complexes. However, political leverage is now shifting and 'environmental justice' is a key phrase behind much of the current policy work and legislation.
- 2.6 Industrial activity is prominent and growing throughout the country, although concentrated in specific sites. South Durban has the largest petrochemical industries in the country, and it refines approximately 60 per cent of South Africa's petroleum. The South Durban industrial basin also contains a wastewater treatment plant, several toxic waste landfill sites, a paper manufacturing plant and a multitude of chemical process industries.
- 2.7 New pollution control technologies will require further training (for design, commissioning, optimisation and operational control). Wits University offers a final-year course in air pollution control, but there is little training or education available in the industry, as well as a shortage of skilled personnel in the filtration industry (Engineering News, 2007).
- 2.8 Mining activities also present negative environmental impacts; pollution from mining activities is probably the most direct cause of groundwater pollution in the country, whilst small waste coal dumps cause both pollution and safety (spontaneous ignition) problems. Gold mining, for example, is a particularly resource-intensive activity, with mining occurring at depths up to about 4,000 metres; the production of one fine ounce of gold requires on average about three tonnes of ore, 5,000 litres of water and 600 kilowatt hours of electricity.

² Exchange rates are valid as of 08/09/2008. This approximates to 1 US Dollar = 7.92 South African Rand.

- 2.9 With regard to waste, by far the largest waste stream is generated from the mining sector. However, there is a lack of available or current waste information from all sectors. Combined with illegal dumping and a lack of regulation/enforcement, there is considerable scope for better waste management systems to be developed in the future.
- 2.10 *'Municipalities in South Africa are a major source of demand for EGS and indirectly also one of the largest suppliers of EGS to industry, government and households. Johannesburg, Cape Town, Durban, Pretoria, and Port Elizabeth Metropolitan Councils are the biggest suppliers of environmental services through their active role in waste collection and management.'* UK Trade & Investment (UKTI), April 2008).

Market segments

- 2.11 The main market segments within EGS, where there is most current and prospective activity, are related to solid waste management – including hazardous waste, water and wastewater treatment, and air pollution prevention and measurement.

OPPORTUNITIES IN ENVIRONMENTAL GOODS AND SERVICES IN SOUTH AFRICA

Solid waste management

Over the last decade waste management has been prioritised within environmental management as well as within the various governmental departments regulating these functions. Local municipalities have also become more accountable to their communities, ensuring that they have an integrated waste management plan in place to adequately provide an equitable service to all. Currently 90 per cent of waste is sent to landfill.

Energy from waste applications present a serious opportunity, particularly with the current state of the electricity market. There is a significant amount of landfill gas used for electricity projects, and this is growing.

Furthermore, landfill will begin to reach capacity in three to five years; this presents a significant driver to increase the rate of recycling. In particular, there may be serious opportunities in mining waste diversion and diversion of rubble to construction projects.

There is a national target to reduce the amount of 'Big Five' waste (plastics, cans, paper, glass and tyres) going to landfills by 70 per cent by 2022, and plans are in place to minimise and treat the remaining 30 per cent (UKTI, April 2008). Whilst there are no government initiatives in place to support this, some provincial authorities are looking to increase the number of recycling facilities and introduce environmentally friendly waste management technologies.

There may also be significant opportunities developing in health care waste, which is currently 100 per cent incinerated, as forthcoming waste legislation is due to target this area.

A study of opportunities, constraints and challenges in the recycling industry – as well as government interventions required to support the sector – has been commissioned by the Enterprise Industry Development Division (EIDD) of South Africa's DTI.

Environmental Management Systems (EMS)

According to UKTI (April 2008), *'there are opportunities in the environmental management systems (EMS) sub sector, as most South African companies are seeking to establish themselves in international markets. Some are already exporting outside Africa to Europe and the USA. They are pushing to acquire the appropriate ISO accreditation for their businesses to ensure that they meet the international standards required. Therefore the demand for international companies that are able to provide EMS expertise to achieve accreditation is high and on the increase. Furthermore, although there are some local companies who can provide this service, the larger SA companies seeking to achieve ISO standard(s) tend to look for international expertise, which they feel carries more credibility with their international customers.'*

Hazardous waste

The Norwegian Pollution Control Authority SFT plans to support the South African environmental authorities in preparing a strategy for hazardous waste.

Water and wastewater treatment

South Africa is experiencing significant – and growing – pressure on its water resources; the lack of major arterial rivers or lakes means that extensive water conservation and control measures are required. The agricultural sector accounts for a high proportion of water withdrawals (available data on water withdrawals from 1990 indicates that 72 per cent of water withdrawal was for agricultural usage, 11 per cent for industry and 17 per cent for domestic usage, although this will have changed significantly as the country has continued to industrialise over this period). Agricultural run-off and urban discharge result in pollution of the country's rivers.

Many rural and suburban communities do not have access to residential waterborne sanitation systems. The municipal systems that do exist have suffered from continued under-investment and lack of maintenance. South Africa will continue to face mounting pressure to provide access to clean drinking water. Contamination of drinking water by wastewater outfall leads to regular outbreaks of waterborne diseases such as cholera and typhoid fever.

Investment through programmes such as ASGISA (see Chapter 4) will see many municipalities put under pressure to both upgrade old wastewater treatment plants, and build new ones to cope with increased capacity needs. This will provide significant opportunities for equipment and service providers, and will continue to require additional equipment and expertise in the area of water and wastewater treatment, for example in purification, monitoring, filtering and pumping.

The US Commercial Service (May 2006) believes that the best prospects would be in: the implementation of biological sewage treatment processes, the treatment and recovery of organics from agro-industrial processes, the treatment and recovery of inorganics in industrial and mining effluents, bio-technological co-treatment of industrial effluent with sewage waste, the upgrading of sewage reticulation plants, upgrading and expansion of existing storm water infrastructure.

In October 2007, the Norwegian Pollution Control Authority SFT signed an agreement concerning co-operation on the administration of smaller wastewater treatment plants, as part of the Environmental Protection Co-operation between Norway and South Africa. This programme, valued at NOK 10 million annually, will include the education of inspectors who have already been through the training programme run by the Department of Environmental Affairs, addressing the more practical aspects of their work. There is also a co-operative project testing out the use of smaller, prefabricated wastewater treatment plants in Durban.

Marine pollution

South Africa is vulnerable to oil spills, due to the high volume of oil shipped around the coastline (on its way from the Middle East to US/Europe). South Africa's response systems to marine pollution caused by a shipping casualty however are considered to be inadequate. The country is located on one of the busiest tanker routes in the world, and yet it has not signed up to the 1999 international protocol on marine pollution with its associated compensation fund. The 1981 Marine Pollution Act employs the 'polluter pays' principle up to a maximum of ZAR 120 million (US\$15 million) to be paid by the insurers of the vessel. This was nearly put to the test by several groundings – the tanker Sealand Express, carrying hazardous cargo and with several thousand tonnes of fuel on board, ran aground off Sunset Beach (Cape Town) during a storm in 2003, and the Treasure sank in Table Bay in 2000 carrying 13,000 tonnes of bunker fuel.

South Africa's regulation of pollutants and discharges into the marine environment is shared between the Departments of Water Affairs and Forestry and Environmental Affairs and Tourism. Whilst there is a comprehensive policy on the regulation of land-derived discharges into the marine environment, there is very little information on discharges or the monitoring of these discharges.

Air pollution

Air pollution is a growing concern in South Africa, largely caused by the reliance of the country's industrial sector on coal for energy. South Africa's coal has a relatively high ash content (up to 45 per cent) and contains approximately 1.2 per cent sulphur. In 2000, it was reported that South African refineries produce approximately 82 tonnes of sulphur dioxide gas daily. Air pollution is particularly concentrated in several industrial 'hotspots', such as South Durban, the Vaal Triangle, and Milnerton in Cape Town, and there are concerns about resulting acid rain.

Historically, air pollution has not been well monitored or regulated. However, the South African Air Quality Act, enacted in 2004, signals the intentions of the regulator to control emissions within licensed limits. The first step is generally to reduce the emission of particulates; industrial plant owners use bag filters, various scrubber designs or electrostatic precipitators (Engineering News, March 2007). Industry believes that compliance on controlling particulate emissions is achievable and affordable with present technologies, but the removal of submicron particulates from flue gas streams will require new technologies.

Anecdotally, however, 'ineffective implementation and enforcement has led to uncertainty by industry, as they are unsure which standards/technology to apply in tackling air pollution, particularly when dealing with emissions from stacks' (UKTI, April 2008).

In transport, regulations apply to diesel vehicles, largely geared to ensuring proper maintenance (although enforcement is weak). On 1 January 2006, South Africa switched from leaded to unleaded petrol in motorised vehicles. Prior to the fuel switch, an estimated 60 per cent of South African vehicles were using leaded petrol. In addition, diesel fuel used in South Africa after January 1, 2006 has ultra-low sulphur content of 0.005 - 0.05 per cent, increasing its cost by \$0.11 per gallon.

The Central Energy Fund (CEF) is also involved in developing the market for low-smoke fuels. Baniettor Mining (owned by BHP Billiton and CEF) owns the mineral rights to torbanite, which could be used to manufacture low-smoke fuels.

Environmental consultancy

The sector is projected to be growing rapidly and, whilst there are a large number of South African consultants in the sector, those South African companies wishing to expand overseas will look to use internationally accredited companies. There is also a shortage of staff with relevant skills in government, and this presents significant capacity-raising opportunities (such as consultancy).

Source: SQW from various sources

3: The market for carbon abatement technologies, renewable energy and carbon financing in South Africa

This section summarises the readily available evidence on the market for carbon abatement technologies (CATs), renewable energy and carbon financing in South Africa. It describes the general growth in the sectors and its drivers and presents information on those segments within the three sectors where there are significant opportunities.

Market growth and its drivers

- 3.1 South Africa's economy is highly energy-intensive; energy intensity in 1999 was 34,462 British Thermal Units (BTU/US\$1990,) compared with 12,638 BTU/US\$1990 in the USA (US Energy Information Administration). South Africa has seen a rapid rise in energy usage over recent decades. This has been matched by a rapid growth in energy production; in the twenty years from 1980 to 2000, total energy production rose by 97 per cent, compared with world growth of 37 per cent over the same period.
- 3.2 The large majority of South Africa's energy consumption is from the use of coal, much of which is used to produce synthetic fuels. Synthetic fuels account for around 76 per cent of South Africa's oil production. Sasol is the world's largest manufacturer of oil from coal, using coal-to-liquids (CTL) technology, and the state-owned PetroSA runs the largest gas-to-liquids (GTL) plant in the world at Mossel Bay.
- 3.3 The country has proven (offshore) oil reserves of 15 million barrels (as of January 2007), although more than half of its oil consumption is imported (mostly from Saudi Arabia and Iran). Nonetheless, South Africa has the second largest oil refinery system in Africa, with major refineries in Durban, Cape Town and Sasolburg. A further 300,000 bbl/d refinery has also been announced in the KwaZulu-Natal province.
- 3.4 The vast majority of South Africa's electricity (90 per cent) is generated in coal-fired power stations by Eskom (Energy Supply Commission, a public utility founded in 1923). Eskom, the continent's biggest power producer, employs almost 33,000 employees (Eskom Annual Report, 2007), and in 2006 had a revenue of ZAR 36 billion (US\$5 billion), putting it among the top nine utilities in the world in terms of sales (top seven in terms of generating capacity).
- 3.5 Eskom's 24 power stations can be found in almost every province of South Africa, and include:
 - ten (base-load) coal-fired power stations (each 2,000-4,000 MW),
 - a nuclear site at Koeberg (1,930 MW) (the only nuclear plant in Africa),
 - six peak load power stations (two HEP stations, two gas turbine, two pumped storage), and
 - In addition, three coal-fired stations were mothballed in 1990, but are in the process of being re-commissioned to meet the growing demand for electricity.
- 3.6 Kendal Power Station is currently the largest coal-fired power station in the world. It has a turbine '*design efficiency*' of 35 per cent. It has an indirect dry-cooling system, meaning that it uses significantly less water in its cooling processes than the conventional wet-cooled power stations.
- 3.7 Eskom uses over 90 million tonnes of coal per annum. Coal mining in South Africa is relatively cheap compared to the rest of the world; in Europe, for example, costs are almost four times higher. The country has the world's sixth largest recoverable coal reserves (53.7 billion short tonnes), accounting for around 5 per cent of the world total, with 70 per cent of this lying in just three coal fields. Coal-firing in South Africa is particularly inefficient, as most of the country's coal is low quality with a low heat value and a high ash content (up to 45 per cent).
- 3.8 Recent years have seen large year-on-year jumps in peak demand. However, Eskom's requests for funding to build new power stations to meet this demand were denied, in part because of the government's intention to privatise the company in the late 1990s (Former President Mbeki admitted in December 2007 that this strategic error is now adversely affecting the country's economy).
- 3.9 Despite the fact that this situation had been predicted several years in advance, Eskom has had to take drastic measures to cope with this mismatch in demand and supply. The current reserve margin is around 8 per cent, while the National Energy Regulator wants 16 per cent. In January 2008 the company introduced a schedule of planned electricity cuts, or '*load shedding*' during peak periods and, on the demand-side, consumers have also been encouraged to conserve power during peak periods. In February 2008, Public Enterprises Minister Alec Erwin announced that South Africans could expect '*tight energy supply*' for another four years (other reports are higher, ranging from seven to 15 years).

- 3.10 Eskom is currently negotiating the import of electricity from neighbouring countries (eg Cahora Bassa in Mozambique provides around 1,200 MW to South Africa out of its total capacity of 1,600 MW).
- 3.11 In January 2008, Eskom announced that it would not take on any new 'mega'-projects (1,000 MW-plus) until around 2012, when it hoped to commission the first generating units at its new Medupi power station, which could – for example – affect the timing of Rio Tinto Alcan's Coeca aluminium smelter. Nonetheless, Eskom has now indicated it will spend around US\$39 billion on building new coal and gas turbine plants by 2012.

Market segments

- 3.12 The main market segments within low carbon technologies where there is most current and prospective activity are related to renewable energies in particular wind and solar with interesting developments in biomass.

Carbon abatement technologies

- 3.13 Looking to the future, the government's intention is to expand generation from nuclear reactors, and about half of the expected increase of Eskom's generating capacity (doubling in size to 80 GW) to 2025 is expected to be nuclear. A Koeberg-type pressure water reactor will not be on stream before 2015, and a pebble-bed modular reactor will not be on line before 2013. A nuclear strategy is expected to be finalised this year by the Ministry of Minerals and Energy.
- 3.14 There is little Carbon Capture and Storage (CCS) activity ongoing in South Africa at the present time, but it could represent an opportunity in future. There may be particular potential for Carbon Abatement Technology (CAT) installations in plants involved in converting coal to gas for the production of liquid fuels and synthetic chemicals. However, CCS on a much larger scale does not seem to support the central sustainable development aims of the government in a way that switching to gas and renewable energies might.

OPPORTUNITIES IN CARBON ABATEMENT TECHNOLOGIES IN SOUTH AFRICA

Carbon Capture and Storage (CCS)

South Africa's reliance on coal, alongside a growing environmental awareness country-wide, means that CCS is a serious potential technology option. CCS would allow the country to make significant cuts in emissions without fundamental changes to their energy systems. South Africa has a large potential for carbon storage (20 gigatonnes).

However, CCS represents an expensive option and one that would increase the cost of power significantly. CCS may even work against sustainable development goals, and could (through the increase in cost) slow the increase of electrification (and provision of some free power to households), that is a central government policy aim.

There are, nonetheless, some options for relatively low cost CCS from specific installations, including mainly plants for gasifying coal for the production of liquid fuels and synthetic chemicals. These installations represent a potential carbon saving of 30 Mt of CO₂ per year that could be sequestered for around US\$20 per tonne. The Department of Minerals and Energy undertook a study to ascertain the potential for carbon storage, which found that the most appropriate source for the first detailed investigation would be the 30 Mt/year of 95 per cent CO₂ emitted by Sasol.

Although the country has no CCS projects underway, it has significant relevant technical expertise already, including geology and drilling, gas transportation by pipeline, and gasification of coal (Sasol and PetroSA).

Generation technologies

New opportunities will become evident as Eskom has indicated it will spend around US\$39 billion on building new coal and gas turbine plants by 2012.

Gas – The building of gas-fired power stations and co-generation projects is being sped up to ensure that by 2010 the reserve margin is closer to 15 per cent.

As stated in the previous section, a growing number of landfill gas to electricity projects are occurring (eg under the CDM), and this is likely to expand yet further.

Low carbon transport fuels

The White Paper on Renewable Energy policy outlines the potential for biomass in transport (biodiesel as fuels – or blended fuels – for vehicles), as well as in cooking, space heating, water heating and refrigeration (fuel wood and other biomass). It also discusses biomass cogeneration as an alternative fuel for industrial activities.

Biodiesel oil crops can be grown in six out of nine provinces. At present no fuel crops are grown for biodiesel, although soya and sunflower (in particular) are grown for human and animal consumption (RET, 2005). The production of biodiesel would therefore require significant investment in new capacity. As the infrastructure for production and distribution is not yet established, nor the legal or regulatory framework, this may be difficult to bring forward in the short-term on a large scale, particularly because of the need to bring together a large number of different government departments. Further, as South Africa is a net diesel exporter, new markets would have to be found for current diesel production. Nonetheless, CEF has recently entered into a joint venture with Sasol to produce 100 million litres of bio-diesel from soya, which may help to remove some of these barriers.

Renewable energy

- 3.15 In general, renewable energy fulfils two of the government's energy objectives: managing energy-related environmental impacts, and diversifying energy supplies. The current energy crisis means that the country is particularly keen to diversify its energy supply.
- 3.16 Currently, there is a very low baseline of renewable energy provision. In 2004, less than 1 per cent of the 200,000 GWh of electricity generated annually in South Africa came from renewables. However, the scope for encouraging its use – both on-grid (for environmental and diversity reasons) and off-grid (as an affordable, reliable and socially acceptable alternative) – is substantial. In the short-term, there is a very real capacity issue, and there will be a significant time-lag before new coal-fired power stations can be delivered.
- 3.17 The University of Cape Town (2005) estimated that South Africa has a potential annual output of 86,843 GWh from renewable energy sources. In 1999, renewable energy accounted for approximately 9 per cent of total energy consumption (Energy Futures, 2000), although most was from fuelwood and dung rather than from modern renewable technologies.
- 3.18 The Eskom/WWF Renewable Energy Fund was announced in 2006. This fund is designed to support grid and off-grid applications for small scale (<1 MW) projects, concept development and/or feasibility studies. It will not cover commercial start-up capital, proven technologies, or pure market research/academic research. Submissions are due to be short-listed by end May 2008, with funding commencing 31 July 2008.

OPPORTUNITIES IN RENEWABLE ENERGY IN SOUTH AFRICA

Wind

In comparison with other renewable energy sources, research by the University of Cape Town showed that wind had the highest potential GWh output, but that the cost of wind generation tended to be higher than most of the other renewable resource categories. It is estimated that wind power could supply at least 1 per cent of the country's projected total annual electricity requirements of 198,000 GWh. (Department of Minerals and Energy, 2002), with good potential along most coastal and escarpment areas with mean wind speeds above 6m/s.

The Klipheuwel Wind Farm, run by Eskom about 40km north of Cape Town, has a generation capacity of 3.16 MW.

A national pilot project at Darling, north west of Cape Town, has been established at a cost of ZAR 70 million (US\$9 million) to generate an estimated 13.2 GWh per year using four wind turbines. This project, run by the Oelsner Group, represents the first independent commercial wind farm venture in South Africa, and there are plans to add another six turbines, followed by a further ten in the long term. The project will be connected to the national grid, and sold to customers who choose to pay a 25c/kWh surcharge for a 'green' energy supply – initially this is expected to be largely business customers. The project is the result of a partnership between national government, the Danish government,

the Central Energy Fund and the Darling Independent Power Producing Company, drawing on a loan from the Development Bank of Southern Africa.

The support for the project by the City of Cape Town, which has signed a 20-year power purchase agreement (for onward sale), indicates that more such schemes could be given the go-ahead.

Biomass

Biomass accounts for almost 10 per cent of net energy use in South Africa. The main sources are fuelwood used in the rural domestic sector, bagasse in the sugar industry and pulp and paper waste in commercial forestry for in-house heat and electricity generation (RET, 2005).

Fuelwood is a valuable national resource, although resources are not evenly distributed and many woodlands are not sustainably managed. Fuelwood is not currently on the government's agenda, and does not currently present a proposition for private investment. Sugar bagasse is considered the most economically viable renewable resource with the highest GWh output (RET, 2005).

The Renewable Resource Database (RRDB) modelling of the wood and pulp industries energy potential (based on availability and energy content) found that sawmills could provide a potential tonnage of 1.57 Mt/year, with an energy potential of 7,639 GWh/year and that pulp mills could provide a potential tonnage of 1 Mt/year, with an energy potential of 4,528 GWh/year (DME, Eskom, CSIR, 2001).

The biomass sector is also witnessing considerable investment activity. The Eastern Cape Biomass company is building a ZAR 70 million (US\$9 million) alternative fuels project, which will produce biomass pellets, intended solely for export through the deep-sea Port of Ngqura, scheduled for completion in late 2008. The Industrial Development Corporation (IDC) has taken a 10 per cent stake in the business. A previous biomass project, Star Biomass, was set up as a joint venture with shipping company Grindrod. However, its plant at Richards Bay, established in 2001 at a cost of ZAR 50 million (US\$6 million), never reached critical mass and the company faltered. The IDC commented in February 2007 that clean fuels were seen as 'risky investments, and that is why the banks don't go there' (SESSA news item, 15 Feb 2007).

Solar

South Africa has always had substantial potential for harnessing solar power. However, there are now new drivers for installing solar capacity because of a lack of investment in existing and new power stations

Photovoltaics (PV): Installed PV capacity – predominantly used in telecommunications networks, small-scale domestic use, game farms, community pumping schemes – is estimated at 12 MW (RET, 2005). PV is starting to be used to power advanced robotic schemes, such as a traffic light system in Cape Town.

Interesting advances are being made in solar PV technologies by South African academics. A Professor at the University of Johannesburg has devised a solar panel that is thinner and up to 50 per cent cheaper than anywhere else in the world. Conventional solar panels only harness 15 per cent of incipient solar energy by the cell; the new panels allow more energy to be generated at less cost (using thinner photovoltaic cells and using different components to the conventional phosphorus and boron doped layers). The technology is already being produced in a pilot project based in Germany, and it is hoped that South Africa's first solar fabrication plant, based in Paarl in the Western Cape, will be up and running in late 2009.

After structuring a beneficial licensing deal, Johanna Solar Technology, based in Germany and owned by a consortium of investors, including the Central Energy Fund (CEF (Pty) Ltd), Venfin, Richemont and Anglo American, has committed to bringing the technological know-how and project management expertise gained through the pilot project back to South Africa (CEF website).

Solar water heating (SWH) accounts for approximately 1 per cent of the solar energy market in terms of GWh, although making affordable provision and the reduction of initial installation costs (possibly by scaling up manufacture and installation) is considered to be a priority in order to scale up further (RET, 2005). Standards have not yet been introduced, and so there is a need to develop these to allow accreditation for manufacturers and installers.

The Department for Minerals and Energy (DME) and CEF are running a six-month solar water heating pilot project for domestic use in middle- to upper-income homes. The current cost of the solar heater is prohibitive, estimated at between ZAR 7,000 (US\$900) and ZAR 20,000 (US\$2,500), and the country's manufacturing capacity is only 10,000 units per annum, so the programme will be linked with subsidies for the units (see section 4). Rolling out SWH more widely to poor off-grid areas may not be viable, until areas are provided with piped water.

Wave energy

The potential for wave energy, particularly along the Cape coastline, is considered to be significant. Average harvestable potential along the entire coast is estimated at 56,800 MW (DME, 2004).

Hydro-electricity

As of 2003, there were eight licensed small hydro facilities with a combined total of 68 MW, and a power generation potential of 9,900 GWh per year (RET, 2005).

Source: SQW from various sources

Carbon finance

- 3.19 Carbon finance is small but growing in South Africa. The Clean Development Mechanism (CDM) allows industrialised countries with a greenhouse gas reduction commitment (Annex 1 countries in the Kyoto Protocol) to invest in projects that reduce emissions in developing countries as an alternative to emission reductions in their own countries, which is often more expensive. CDM projects must prove ‘additionality’ – ie that the planned reductions would not occur without the additional incentive provided by emission reductions credits.
- 3.20 According to a report by UKTI (March 2008), South Africa has been slow to take up CDM projects, with South African projects accounting for just 13 of the 952 registered verifiable emissions reduction projects registered on the UNFCCC website as of March 2008 (there are a further ten CDM projects at the validation phase). These are set out in Table 3-1, and full details can be found on the UNFCCC website (<http://cdm.unfccc.int/Projects/index.html>).

Table 3-1: CDM projects in South Africa

Kuyasa low-cost urban housing energy upgrade project
Lawley fuel switch project
PetroSA biogas to energy project
Rosslyn brewery fuel switching project
Durban landfill-gas-to-electricity project – Mariannhill and La Mercy landfills
Tugela Mill fuel switching project
EnviroServ Chlookop landfill gas recovery project
Omnia fertiliser limited nitrous oxide reduction project
Mondi Richards Bay biomass project
Sasol Nitrous Oxide Abatement Project
Transalloys Manganese Alloy Smelter energy efficiency project
Catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd
N ₂ O abatement project at nitric acid plant No. 11 at African Explosives Ltd

Source: UNFCCC website

- 3.21 Whilst South Africa has been relatively slow to take up CDM projects, it is nonetheless amongst the top ten countries in terms of volume of certified emission reductions (CERs) generated by registered projects, although this list is dominated by China and India. As of April 2008, South Africa had a 1 per cent share of the expected global annual CER output (or 2.5 million CERs out of 210 million globally).
- 3.22 The UKTI paper (March 2008) states that: *‘Project developers in South Africa believe the reason for the slow uptake of CDM projects in South Africa is due to the lack of capacity/project development knowledge on the ground and a nervousness of the potential risk with the uncertainty of post Kyoto in 2012.’*
- 3.23 The Designated National Authority (DNA) to oversee CDM projects in South Africa is the Department of Minerals and Energy (DME). Although the CDM process can be complex, the DNA in South Africa is considered to be well organised and is being used as a model to be implemented in other African countries.

4: Policy and regulatory frameworks

This section describes the governance and trade policy context, the extent to which environmental policies and regulation have become more demanding and the institutions responsible for trade, investment and environmental policy and regulation.

Widening democratic participation, sharing growth

- 4.1 South Africa benefits from a democratic constitution. Freedom of Information (FOI) laws are in effect, legally guaranteeing public access to government records. Nonetheless, South Africa scores five in the Corruption Perception Index (CPI) where ten is highly clean and zero is highly corrupt³.
- 4.2 The broad-based Black Economic Empowerment (bbBEE) programme was introduced after the end of apartheid rule in 1994, and culminated in the Black Economic Empowerment Act (2003), with a target of 25 per cent BEE ownership of energy companies by 2014. This sets an important context for understanding all government policies and inward investment.
- 4.3 An inter-departmental committee on Indigenous Knowledge Systems has been established, including: Department of Environment Affairs and Tourism, Department of Science and Technology, Department of Agriculture, Department of Health, and Department of Trade and Industry. An Indigenous Knowledge Systems Bill is under consideration.
- 4.4 The Accelerated and Shared Growth Initiative of South Africa (ASGISA) has spent ZAR 372 billion (US\$47 billion) on major infrastructure projects, including sanitation and wastewater provision and energy distribution, for example, through the improvement of municipal service delivery.

Trade and investment

- 4.5 The Government viewed economic restructuring through trade liberalisation, deregulation and privatisation as important for growth and employment generation in the long run, despite short-term transitional costs. There have been political difficulties in pushing privatisation forward and the Government has recently shifted its focus from pursuing wholesale privatisation to developing profit oriented public sector enterprises.
- 4.6 Since the early 1990s, South Africa has been involved in a trade liberalisation process. As a result, the decline in tariffs was uninterrupted throughout the 1990s and the weighted average tariff decreased by one third between 1993 and 2000. Moreover, the highly complex tariff regime was simplified. South African trade policy relies on unilateral, bilateral and multilateral trade liberalisation in the context of the World Trade Organization (WTO). The free trade area agreement with the European Union, by far the most important trading partner of South Africa, was signed in 1999 and progressively implemented from 2000 onwards. Unilateral trade liberalisation is also at the top of the South African political agenda, mainly because of its commitments to the WTO and the Growth, Employment and Redistribution Programme.
- 4.7 bbBEE is a key element to doing business in South Africa. It is the cornerstone of the South African Government's efforts to educate and train the huge sector of the population that was disadvantaged under apartheid. It aims to accelerate the participation of black people (which includes African, Indian and Coloured people) in the economy.
- 4.8 bbBEE intends to achieve this by encouraging change in seven key areas of business: ownership; management control; employment equity; skills development; preferential procurement; enterprise development; and residual aspects such as corporate social investment. The bbBEE process is primarily driven by legislation, regulation and contractual undertaking. The key acts which provide the legislative framework for the transformation of the economy are the Skills Development Act; the Employment Equity Act, the Preferential Procurement Act, and the broad based Black Economic Empowerment Act.

³ The CPI is based solely on perceptions derived from 14 different polls and surveys of business people and country analysts

Environmental policy

- 4.9 Section 24 of the South African constitution ensures the right of citizens to live in a clean and healthy environment, and also makes provisions for the benefit of present and future generations, *'through reasonable legislative and other measures that: prevent pollution and economical degradation, promote conservation, and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.'*
- 4.10 The White Paper on Environmental Management, developed by the Department of Environmental Affairs and Tourism (DEAT) in 1997, provided the framework for modern environmental policy in South Africa.
- 4.11 The National Environmental Management Act (1998) brought in national standards to consolidate the country's once-fragmented environmental legislation. It covers: air, water and marine pollution, waste management, deforestation, energy efficiency and biodiversity conservation. Whilst it is generally accepted by industry as providing comprehensive coverage of the key sub-sectors, there 'appears to be a vacuum between setting generic policies and focusing regulations on specific sub-sectors' (UKTI, April 2008), and environmental enforcement has been limited to date.
- 4.12 The third IPCC assessment report (2007) stated that climate change is featuring higher on the South African government's agenda, but that it needs to be mainstreamed in all government departments. Whilst the country is not obligated to reduce carbon emissions, it is accepted that the more developed of the developing countries would need to accept 'some kind' of emissions reductions.
- 4.13 There is now a government commitment to create *'an enabling structure, strategy and action plan'* to stimulate trade in EGS. A 2006 report baselining the sector for the South African Department of Trade and Industry (DTI) stated that, unlike most other industries, the growth of the EGS industry is largely driven by government activities and policies. The SA EGS Forum was established in August 2007, ostensibly to unite the sector. However, anecdotal evidence suggests that there is some confusion across DEAT and the South African DTI as to the definition of the EGS sector.
- 4.14 The EGS Forum has produced a draft South African EGS Sector Growth Strategy and Action Plan (2007), which recognises EGS as a growth sector, *'with the potential to make a significant contribution to national economic objectives.'* It is explicitly recognised that the Action Plan needs to demonstrate its contribution to the poverty alleviation agenda.

Energy policy

- 4.15 Post-apartheid policy has tended to have a strong focus on energy for development. The country is committed to providing universal access to electricity by 2012. In practice, this means a combination of grid expansion and the deployment of Remote Area Power Supply (RAPS) systems. The South African off-grid electrification programme grants private companies the right to develop off-grid energy utilities, with exclusive rights to government subsidies to cover capital costs over five years.
- 4.16 In 2001, the government introduced a subsidy for free basic electricity for households on the grid, equivalent to 50kWh per month.
- 4.17 The National Energy Regulator of South Africa (NERSA) regulates policy across the South African energy industry, and is responsible for the country's energy plan.
- 4.18 Public Enterprises Minister Alec Erwin has stated that the government's aim is for independent producers to contribute around 30 per cent of the country's electricity. Subsidies for synthetic fuel production are being phased out for Sasol, although Mossgas continues to receive substantial financial support.

- 4.19 In general, renewable energy fulfils two of the government's energy objectives: managing energy-related environmental impacts, and diversifying energy supplies. The national government has set a target of an additional 10,000 GWh a year in renewable energy for the national grid by 2013.
- 4.20 In light of the current energy crisis, a statement on Cabinet's Renewable Energy Development, released by the Government of South Africa on 25 January 2008, named a number of projects the Department of Minerals and Energy have embarked on, including: a hydropower project, a project to convert biogas to electricity, wind power projects, and a green power pilot project, which includes biomass electricity cogeneration.

Future regulations and legislation

- 4.21 There are various bills and regulation in the pipeline, relating to issues that include pollution and waste minimisation (eg the National Environmental Management: Waste Management Bill; and the Pollution/Waste Minimisation Act); whilst these are currently with Parliament, it is uncertain how long they will take to come forward.
- 4.22 An important point is that key environmental policies have in the past been delayed in terms of embedding into legislation. At least a part of this is as a result of the strong industry lobby. Currently DEAT and the Council for Scientific Industry Research (CSIR) are looking to implement Defra's (UK) policy model to encourage bills to be supported by robust research and to enable industry buy-in. Passing environmental bills into legislation should be quicker in the future.
- 4.23 There is currently a shortage of staff with relevant skills in government, and this presents significant capacity-raising opportunities (such as consultancy).
- 4.24 Environmental enforcement is also increasing, particularly with the formation of the Environmental Management Inspectors – dubbed the 'Green Scorpions' – in 2005, which is beginning to change the common perception in South Africa that government lacks the will to enforce its environmental legislation. There are now 866 Inspectors in 15 institutions across the country. Furthermore, DEAT is set to sign a formal agreement with the South African Police Service to allow the Green Scorpions to carry their own criminal dockets or case files, and to hand those over for prosecution to the National Prosecuting Authority, which could allow for 'more effective and efficient' prosecution of environmental crime.

NATIONAL ENVIRONMENTAL INITIATIVES AND REGULATIONS

Central Energy Fund, NEEA and SANERI

The Central Energy Fund, CEF (Pty) Ltd. manages the operation and development of the oil and gas assets and operations of the South African government, and is increasingly involved in the search for 'appropriate energy solutions' to meet the future energy needs of the country. These include solar, biomass, wind and renewable energy sources. In 2006, the CEF group of companies announced that they would be investing more than ZAR 30 billion (US\$4 billion) over the next four years as it 'intensifies its quest for new energy sources'. Capital expenditure would be split into: Feedstock projects (ZAR 7.4 billion) (US\$0.9 billion), Exploration (ZAR 2.5 billion) (US\$0.31 billion), Security of supply opportunities (ZAR 15 billion) (US\$1.9 billion), Infrastructure (ZAR 1.4 billion) (US\$0.2 billion), Low smoke fuels (ZAR 2 billion) (US\$0.3 billion), Renewable Energy (ZAR 2.6 billion) (US\$0.3 billion), Other (ZAR 0.3 billion) (US\$0.04 billion).

CEF established two new energy bodies in 2006 – the National Energy Efficiency Agency (NEEA) and the South African National Energy Research Institute (SANERI) – to deal with the country's energy challenges.

NEEA will oversee the implementation of Eskom's Demand Side Management (DSM) and other energy efficiency projects, after it was agreed (following consultation) that the existing governance arrangements relating to the DSM Fund need to be reformed. In the interim, however, DSM funds will remain with Eskom, which, as the main implementing agency will continue to manage these funds under the oversight of the NEEA governance body. As well as prioritising and recommending projects, NEEA will develop strategies to tackle the growing demand for energy in the country, and will support, co-ordinate and invest in energy efficiency training country-wide.

SANERI is responsible for R&D in the energy industry. Its remit is 'to generate new ideas and to develop practical guidelines for how South Africa can best take advantage of what nature offers us in the form of clean and renewable energy', and to support the development of technologies to fully exploit the country's resources. It will focus on energy policy, planning and modelling, as well as cleaner fossil fuel use (including clean coal), renewable energy, and alternative energy sources (including fuel cells and hydrogen). It provides bursaries for post-graduate research into cleaner energies, and has funded Stellenbosch University to act as the hub of a postgraduate programme in renewable and sustainable energy studies.

Renewable Energy Subsidy Office (REFSO)

REFSO has began disbursing subsidies for renewable energy projects worth ZAR 4 million (US\$0.5 million), for example through providing a subsidy of 20-30 per cent on domestic solar water heating units (see below).

Energy White Paper (DME, 1998)

The Energy White Paper outlines the following major objectives for government:

Increasing access to affordable energy services

Stimulating economic development – encouragement of competition within energy markets

Managing energy-related environmental and health effects

Securing supply through diversity – increased opportunities for energy trade and diversity in both supply sources and primary energy carriers.

It is debatable whether the first of these encourages diversity or greater production of cheap electricity from coal, but the other three objectives are in line with a diversification of energy supply, particularly into low-carbon and renewable energies.

White Paper on Renewable Energy Policy (DME, 2004)

This policy targets the provision of 10,000 GWh per annum over 10 years from renewable sources (mainly biomass, wind, solar and small-scale hydro projects) by 2013. This is equivalent to approximately 4 per cent of the country's estimated electricity demand.

An assessment of the macroeconomic impacts of pursuing this policy suggests that it would create more than 35,000 jobs, that it would contribute more than ZAR 5 billion (US\$0.63 billion) to GDP, and that ZAR 687 million (US\$87 million) would be added to the incomes of low-income households (RET, 2005; DME, 2004).

Solar water heating initiative (DME, CEF)

The DME has established a concessioning process for off-grid rural electrification, and has installed over 20,000 solar home systems in four concession areas.

The DME and CEF are running a solar water heating pilot project for domestic use in middle- to upper-income homes that will see a million solar water heaters installed over the next three years. According to a departmental statement, the DME is confident that the project will see a marked reduction in electricity use; potential savings have been estimated at 650 MW. As well as homes, the programme is targeting group houses (such as army bases and mine residences), commercial and industrial applications.

Given the prohibitive cost of the solar heater (see section 3.18), REFSO will provide a subsidy of 20-30 per cent depending on the cost of the unit.

National Waste Management Strategy Implementation (NWMSI)

The National Environmental Management: Waste Management Bill is due to be passed imminently.

The NWMSI project comprises four components: Recycling; Waste information system; Health Care waste; Project management and cross-cutting issues, including legal, financial, capacity building, etc.

Air Quality Act, 2004

The Act is seen as an important move to control industrial emissions, and includes provision to reward public representatives for informing the chief air pollution control officer about contraventions.

National Biodiversity Strategy and Action Plan

The NBSAP was developed, with wide stakeholder consultation, between 2003 and 2005. However, much of the existing policy and legislation is fairly new, and many aspects remain to be implemented.

The strategy sets out quantitative biodiversity targets for the 5-year action plan, based on a scientific assessment by the NBSA in 2004. It covers terrestrial, river, estuarine and marine ecosystems.

The NBSAP identified nine priority geographic areas, as well as priorities for freshwater, estuarine and marine ecosystems. Within these areas, biodiversity considerations have to be incorporated into municipal spatial plans. A dialogue between conservation organisations and the Chamber of Mines aims to improve biodiversity practices within the industry and prevent loss of natural habitat in critical sites.

The Biodiversity Act (2004), also allows for the establishment of a Bioprospecting Fund, for the collection and distribution of financial benefits arising from bioprospecting.

Source: SQW from various sources

Annex A: Definitions of environmental goods and services, renewable energy, carbon finance and CATs

A.1 The Defra/BERR Environmental Industries Unit has defined the individual EGS sectors as follows:

Table A-1: Constituent sub-sectors of the Environmental Goods and Services sector

Sub-sector	Description	Examples of types of activity
Air Pollution Control	Defined as products, systems and services for the prevention, reduction and removal of gaseous and particulate pollutants from air	External and internal emissions and odour control, filters and catalytic converters
Cleaner Technologies and Processes	Defined as products, systems or services for cleaner more resource efficient technologies, processes or products which are not covered elsewhere	
Decommissioning/Decontamination of Nuclear sites	Defined as products, systems and services required for the decommissioning of existing nuclear liability sites and structures	Consultancy, decontamination, recycling and compaction technologies, waste collection and containment
Environmental Consultancy	Defined as services to provide assessment and advice relating to environmental issues	Environmental audits, environmental impact assessment, corporate environmental responsibility
Environmental Monitoring, Instrumentation and Analysis	Defined as products, systems and services for measuring and monitoring environmental parameters	Water, air and soil quality, meteorological conditions and flow rates
Energy Management/Efficiency	Defined as products, systems and services for energy management and energy efficiency	Energy consultancy/audits, building energy management systems, energy efficient products and efficiency advice
Marine Pollution Control	Defined as products, systems and services for controlling, clean up and minimising marine pollution	Products such as oil absorbents and booms and services such as marine pollution preventing techniques
Noise & Vibration Control	Defined as products, systems and services for monitoring and reducing noise and vibration.	Noise meters, monitoring systems, acoustic buffers, enclosures and barriers and silencers
Recovery and Recycling	Defined as products, systems and services for waste segregation, recovery and recycling	Paper, organics, metals, plastics, glass, demolition and construction wastes, vehicles and white goods
Remediation and Reclamation of Land	Defined as products, systems and services for the identification, assessment and remediation/reclamation of land and buildings, including prevention of contaminant dispersal	Absorbents and injection equipment, monitoring systems and proprietary treatment processes and sampling/analysis and site investigation/engineering
Waste Management	Defined as products, systems and services for the minimisation, collection, treatment (not recycling) and disposal of waste	Advice on waste minimisation, landfill, mechanical and biological treatment, regulatory advice and technologies such as specialised containment, shredders, compactors and waste management vehicles
Water Supply and Wastewater Treatment	Defined as products, systems and services for the management of the fresh water environment, provision, treatment, distribution and storage of clean water and wastewater for industrial and domestic users	Resource development, demand management, manufacture of wastewater treatment equipment, design, construction, installation and operation of water and wastewater treatment facilities

Source: DEFRA, *Sustainable Consumption and Production – Development of an Evidence Base: Annex 1, UK Government Definitions of the Environmental Goods and Services Sector (Draft Review September 2006)*

- A.2 For the purposes of the study, we have taken Renewable Energy and Carbon Finance out of the definition of EGS and CATs and treated them as separate sectors.
- A.3 Definitions for the individual CATs sectors are available from different sources including BERR's Strategy for CATs (2005), certain trade associations and prominent market leaders.

TABLE A-2: CONSTITUENT SUB-SECTORS OF THE CARBON ABATEMENT TECHNOLOGIES SECTOR

Sub-sector	Description	Examples of types of activity
Carbon Capture & Storage (CCS)	Defined as a multi-stage process where carbon from power generation is captured either before or after combustion and transported to a long-term storage in geological formations. This approach can reduce emissions by up to 85 per cent depending on the type of non-capture plant displaced	The entire supply chain for CCS technologies from R&D to demonstration and deployment. This includes manufacturing, as well as engineering and financial/business consulting services across the three main stages: <ul style="list-style-type: none"> • Carbon capture at plant • Transportation to a storage • Storage in a geological formation
Generation technologies that provide higher conversion efficiency	Defined as higher efficiency conversion processes, where the amount of fuel consumed and the associated emission of CO ₂ are reduced and the conversion processes are made more efficient (eg emission reductions of 10-30 per cent are possible depending on the performance of the old and replacement plant. Even higher levels can be attained by adding co-firing with biomass (typically a 5-10 per cent mix)	The entire supply chain for renewable technologies from R&D to demonstration and deployment. This includes manufacturing, as well as engineering and financial/business consulting services. Main technologies are: <ul style="list-style-type: none"> • Supercritical boilers • Integrated Gasification Combined Cycle (coal) • Combined Cycle Gas Turbine (gas)
Substitution to low carbon transport fuels	Defined as fuels used for transport based on the fermentation and distillation of replenishable organic matter, such as agricultural crops (eg sugar cane or beet, rapeseed) or woody material. Commonly known as biofuels, the main commercial varieties are bioethanol and biodiesel, where the former can be used as the main fuel and the latter is typically mixed with standard diesel in different proportions. Currently, there are second and third generation biofuels	Production of crops and other organic matter to be converted into fuel. The design of technology and equipment for producing biofuels. The production of different types of low-carbon fuels including bioethanol and biodiesel
Asset Management	Defined as planning, procurement and maintenance of energy generation facilities	Business planning, condition assessment, data gathering, technical maintenance

Source: BERR, British Biogen, Energy Asset Management plc

A.4 Renewable energy is defined broadly in all sources consulted and a generic definition is as follows:

TABLE A-3: RENEWABLE ENERGY

Sub-sector	Description	Examples of types of activity
Renewable energy	Defined as energy technologies that use natural resources such as sunlight, wind, flowing water, tides and waves, biomass and geothermal heat. The availability of these resources is either unaffected by energy capacity installed (eg solar and wind energy) or can be replenished in the short-term (eg hydro and biomass)	The entire supply chain for renewable technologies from R&D to demonstration and deployment. This includes manufacturing, as well as engineering and financial/business consulting services. Main technologies are: <ul style="list-style-type: none"> • Wind (onshore and offshore) • Solar (thermal and electric) • Hydro (smaller scale) • Biomass (heat and power) • Geothermal • Marine (wave and tidal)

Source: various sources

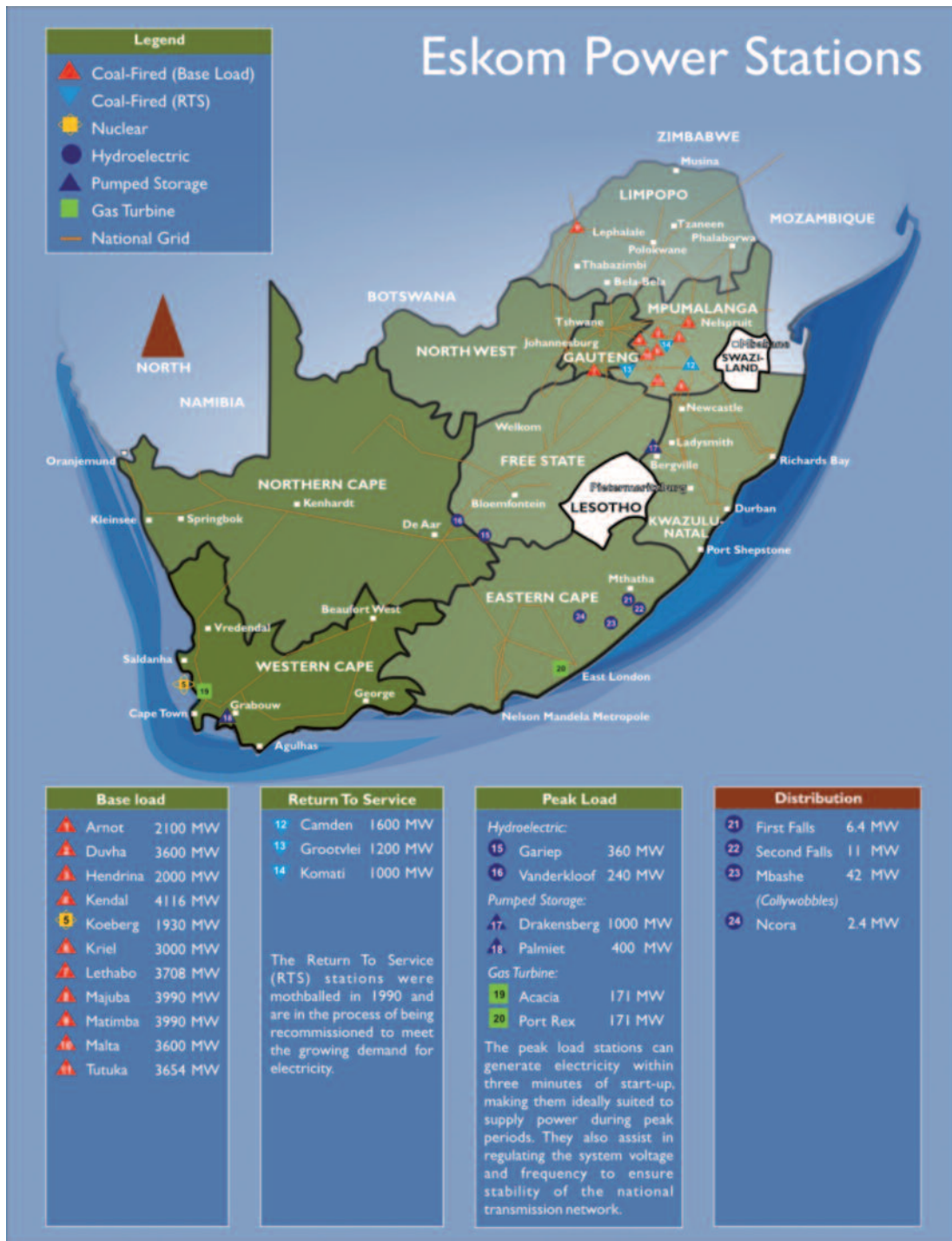
A.5 Carbon Finance is also a term which is not standardised across the literature and a definition reflecting the content attributed to it by several sources is as follows.

TABLE A-4: CARBON FINANCE

Sub-sector	Description	Examples of types of activity
Carbon finance	Defines as the investments in greenhouse gas emission reduction projects, the creation (origination) of tradable commodities on the 'carbon market', and the provision of financial and business services associated with all of the above	Trade in carbon commodities and derivatives on different markets and exchanges, such as CERs, EAUs, VERs and others CDM and JI project assessment, registration, finance and development

Source: various sources

Annex B: Power stations in South Africa



Source: Eskom website - www.eskom.co.za

Annex C: Bibliography

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