Energy sector reform and the protection of the rights contained in section 24 of the South African Constitution

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DECLARATION

I, Nokulunga Zulu, declare that this study is my own work and all the sources have been indicated and acknowledged by means of complete references.

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Nokulunga P Zulu **Date**

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ABSTRACT

South Africa is blessed with abundant reserves of both high- and low-grade coal.Current South African energy activities relate primarily to the generation of electricity by means of the burning of fossil fuels and more specifically coal. Fossil fuel-based electricity generation results in a number of environmental and social impacts. Section 24 of the Constitution of the Republic of South Africa, gives all citizens a right to live in an environment that is not harmful. Furthermore, it mandates the government with a duty to protect the environment for the present and future generations through legislative and other measures. However, when looking at the current state of energy generation in South Africa, energy reform is needed to curb the impacts of generating energy using coal. There is a dire need to transition towards renewable energy/ cleaner energy generation.

South Africa (SA) is mindful of its international obligations to reduce greenhouse gas (GHG) emissions. During the 15th Conference of Parties (COP 15) meeting in Copenhagen, President Jacob Zuma announced a target reduction on CO_2 emission by 34% in 2020 and 42% by 2025, subjected to technical, financial and capacity support from developed countries. SA's commitment to reduce GHG emissions is evident, as most policies have visions of moving towards renewable energy as a form of energy generation. For SA to achieve these emission reductions and still supply sustainable energy for the population's growing energy needs, nuclear energy has been identified as one of the best energy options given as the country has uranium (a key input in nuclear energy generation). The South African government has already started the process of preparing for nuclear power plant so as to meet the increasing national energy demand of electricity supply. This paper will be exploring the reforms in the energy sector in South Africa and conducting feasibility analysis of nuclear energy as best energy option.

Keywords:

Renewable energy, nuclear energy, fossil fuels, environmental impact assessment, environmental rights, Section 24 of the Constitution of the Republic of South Africa

LIST OF ABBREVIATIONS

AU	African Union
CaO	Calcium Oxide
CAPCO	Chief Air Pollution Control Officer
CDM	Clean Development Mechanism
CH4	Methane
CLRTAP	Convention on Long-Range Trans-boundary Air Pollution
CO	Carbon Monoxide
CONNEPP	Consultative National Environmental Policy Process
CoP	Conference of Parties
DME	Department of Minerals and Energy
EURATOM	European Atomic Energy Community
GDP	Gross Domestic Product
GHGs	Greenhouse Gases
GWe	Gigawatt electrical
GWh	Gigawatt hour
Hg	Mercury
ICESCR	International Covenant on Economic, Social and Cultural Rights
IRP	Integrated Resource Plan
Mtoe	Millions of tons of oil equivalent
Mtpa	Million tons per annum
MW	Megawatts
NAQMP	National Air Quality Management Programme
NEM: AQA	National Environment Management: Air Quality Act
NEMA	National Environmental Management Act
NEPAD	New Partnership for Africa's Development

Neth QHR	Netherlands Quarterly Human Rights
NOx	Oxides of Nitrogen
NSG	Nuclear Suppliers Group
ODS	Ozone Depleting Substances
OECD	Organisation for Economic Co-operation and Development
PM	Particulate Matter
POP	Persistent Organic Pollutants
SA	South Africa
SAICM	Strategic Approach to International Chemical Management
SO_2	Sulphur Dioxide
TWh	Tera-Watt hour
WESSA	Wildlife and Environment Society of SA
WHO	World Health Organisation
WSSD	World Summit on Sustainable Development

Contents

1 Introduction

Current South African (SA) energy activities relate primarily to the generation of electricity by means of the burning of fossil fuels, more specifically coal. Coal-fired electricity generation currently contributes to over 90% of South Africa's electricity, with Eskom accounting for a staggering 62.3% of South Africa's emissions in 2011.[1] Fossil fuel-based electricity generation results in a number of environmental and social impacts. The combustion of coal during the electricity generation process produces carbon dioxide (CO_2), carbon monoxide (CO), methane (CH_4), particulate matter (PM), oxides of nitrogen (NOx), sulphur dioxide (SO_2), mercury (Hg), and a wide range of carcinogenic chemicals and heavy metals.[2] Sulphur dioxide and nitrogen oxides (SO_2 and NO_X) have negative impacts on human health and on the habitat of animals and plants.[3] Nitrogen oxides contribute to the depletion of the ozone layer. Where CO_2 is projected to have a negative impact on climate at a global level, SO_2 and NO_X impair the environment at a more local level.[4]

South Africa is the world's fifth largest producer of coal, and is already the sixth largest consumer. It must be borne in mind that coal is a finite resource and therefore non-renewable.[5] The coal-based generation of electricity also requires a significant use of water, a scarce and important resource in South Africa. Greenpeace is of the opinion that the aforementioned facts underline the inherently unsustainable nature of coal-based electricity generation.[6] Furthermore, generating electricity by burning coal is an extremely destructive practice as it contributes to environmental degradation and various unwelcome social impacts relating primarily to the detrimental impacts of fossil fuel-based electricity on the health of SA citizens, as some epidemiological studies find these pollutants to contribute to bronchitis, asthma and lung cancer, and also hospital admissions or emergency room visits related to, cardiac conditions and coronary obstructive pulmonary disease.[7]

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1 Steele 2012 *Green Peace* 4.
2 Riekert and Koch 2012 *Journal of Energy in Southern Africa* 52-66.
3 Levy *et al* 2014 *Environmental Health Perspectives* 65-72.
4 Eskom Integrated Report, 2011.
5 Munnik "The social and environmental consequences of coal mining in South Africa" 1-24.
6 Munnik "The social and environmental consequences of coal mining in South Africa" 1-24.
7 Chikosi "The True Cost of Coal in South Africa" 2010 2-3.

Environmental impacts relate primarily to the effects of climate change, which are exacerbated by the amount of GHG emissions related to fossil fuel-based electricity generation.[8] Poor environmental conditions relate to three key dimensions of poverty: (1) Livelihoods: Poor people tend to be most directly dependent on natural resources as they use coal to cook and to heat up the rooms, and are therefore they are the first to suffer when these resources are degraded. (2) Health: Poor people suffer most when water and air are polluted because pollution sources are often placed in or near poor communities; and (3) Vulnerability: Poor people are most often exposed to environmental hazards and environment-related conflict, and are least capable of coping when these occur.[9]

It is argued that for South Africa to play its part in any global agreement on the reduction of greenhouse gas emissions, South Africa will need to drastically reduce its reliance on fossil fuels for the supply of energy in order to decrease its carbon intensity.

From the foregoing facts the assumption is made that the current coal-dominated electricity generation methods in South Africa are not contributing to the protection of the rights contained in section 24 of the *Constitution of the Republic of South Africa*, 1996[10] which states that everyone has the right:

> (*a*) *to an environment that is not harmful to their health or well-being; and*
>
> *(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that -*
>
> *(i) prevent pollution and ecological degradation;*
>
> *(ii) promote conservation; and*
>
> *(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.*

Section 24(b) also states that legislative and other measures should be formulated and implemented which aim to realise the rights contained in section 24 of the Constitution, and of the Constitution more generally. The State is required to respect,

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8 Steele 2012 *Green Peace* 4.
9 World Health Organisation (hereinafter WHO).
10 Hereinafter referred to as Constitution.

protect, promote and fulfil the right contained in section 24 of the Constitution.[11] Environmental problems in South Africa have undoubtedly been exacerbated by past apartheid policies, which leaves the present government faced with the challenge of redressing the imbalances of the past environmental policies in the face of a rapidly growing population and increasing development.[12] Another important aspect of the right created by section 24(a) is the right to an environment "that is not harmful to individuals' health and their wellbeing".[13]

Energy sector reform is needed to curb the detrimental impacts of coal-based electricity generation on the environment and human health in South Africa and should be regulated in terms of the law and policy capable of facilitating the protection of section 24 rights. The government needs to ensure that the obligation contained in section 24(b) of the Constitution is achieved by regulating energy sector reform in a constitutionally sound manner.

These facts lead to the following research question: what should be included in the law and policy aimed at regulating energy sector reform capable of contributing to the realisation of the rights contained in section 24 of the Constitution? The aim of the current research is therefore to investigate whether or not South African energy law and policies facilitate energy sector reform, thereby ensuring that the rights contained in section 24 of the Bill of Rights are realised. In order to reach this aim and to answer the research question, the following topics will be discussed. Chapter 1 will give an introduction and formulate a problem statement for the research; Chapter 2 will give a background into energy generation in South Africa. The social, economic and environmental impacts of coal will also be discussed in this chapter. Chapter 3 look at the theoretical background to the legislation for the realisation of other socio-economic and environmental rights. In this chapter the law and policies resulting from the duty placed on the State in terms of section 24 will be discussed in order to ascertain to what extent energy sector reform is embodied, and secondly, to what extent energy sector reform as prescribed by the law and policy works towards realising the right to an environment as contained in section 24. Current SA energy law and policy

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11 Kidd *Environmental Law* 21-24.
12 *3rd Economic and Social Rights Report:* Environmental Rights.
13 *3rd Economic and Social Rights Report:* Environmental Rights.

pertaining to energy sector reform will be discussed in chapter 4. The following pieces of SA energy legislation and policies pertaining to energy reform will be looked at: *White Paper*, 1998; *White Paper*, 2003; *Energy Act*, 2008; *National Development Plan*, 2030; *National Environmental Management Act* (NEMA); *White Paper on Renewable Energy of the Republic of South Africa; Draft Energy Efficiency Strategy of the Republic of South Africa and Integrated Resource Plan.* Also general pieces of environmental legislation such as *NEMA* as the framework legislation and the *National Environmental Management Air Quality Act* (NEM:AQA) will be discussed to the extent to which they are relevant to the central research question.

The energy options for South Africa will also be discussed, under the following topics: nuclear energy as one of the energy options for South Africa, South Africa and nuclear energy developments, South African Government in R-1trillion nuclear strategy energy options in South Africa, and the barriers to renewable energy implementation.

Chapter 5 will look at international law and policy relevant to energy sector reform such as: The *United Nations Conference on Environment and Development* (UNCED), the 1992 *United Nations Framework Convention on Climate Change (UNFCCC),* the *Rio Declaration on Environment and Development, the Rio Principles* and other principles such as the Stockholm, Sovereign and precautionary principles. The *Convention on Long Range Trans-boundary Air Pollution,* the 1985 *Vienna Convention for the Protection of the Ozone Layer,* the *Montreal Protocol*; 1987, *the International Covenant on Economic, Social and Cultural Rights* (ICESCR) will also be discussed. South Africa has an obligation in terms of international agreements to protect the ozone layer and limit GHG emissions, therefore it is vital to look at these agreements that SA is a party/signatory to. Lastly, Chapter 6 will provide a conclusion to the research and make recommendations where necessary.

2 Background to energy generation in South Africa

2.1 Introduction

South Africa's is a coal-based economy. According to the United Nation Framework Convention on Climate Change (UNFCCC); South Africa emits almost 400 Mt CO2 annually, mainly from the electricity and Syn-fuel industry.[14] Fossil fuel contributes 89.2 % as the primary energy resource, and coal represents 93% of the primary energy source. Three-quarters of South Africa's primary energy supply and 93% of its electricity are derived from coal.[15] Though coal has brought great economic prosperity to countries that have it, the way coal is produced and used is inefficient and has adversely affected local, regional, and global environments, hence the ongoing debate about making energy systems more sustainable.[16]

The main sources of CO_2 emissions in Southern Africa relate directly to the generation and consumption of energy, namely fossil fuel burning (liquid fuels and especially coal in the thermal power stations of South Africa) and deforestation due to the use of traditional source of biomass as primary energy source. Therefore, while the sub-region's contribution to global energy-related GHG emissions is low, the SADC energy sector is the highest contributor to GHG emissions in the sub-region itself. In 2009 electricity and heat generated from the direct combustion of fossil fuels contributed 41% towards global CO_2 emissions, with coal, oil and gas being the major contributors. While coal represented only one-quarter of the total primary energy supply, it accounted for 43% of global CO_2 emissions due to its heavy carbon content per unit of energy released.[17]

During 2009, 65.9 % of electricity production came from coal. South Africa is among the top 15 most energy-intensive economies in the world and emits over 400 million tons of CO_2 every year and is ranked as the 13th largest CO_2 emitter in the world.[18]

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14 Landi *Carbon capture and storage* 2011.
15 Landi *Carbon capture and storage* 2011.
16 Davidson *Sustainable energy in sub-Saharan Africa* 2.
17 International Energy Agency: *World Energy Outlook* 2011.
18 Department of Minerals and Energy, 2011.

The ever-increasing demand for electricity has intensified the world's dependence on fossil fuels, resulting in the gradual escalation of GHG emissions expelled into the atmosphere, which in turn results in carbon emissions from the generation of electrical energy claiming the principal position as the cause of global warming.[19] Internationally, coal is the most widely used primary fuel, accounting for approximately 36% of the world's electricity production, and this situation is likely to remain until at least 2020.[20]

Coal-fired electricity generation currently contributes to over 90% of South Africa's electricity, with Eskom accounting for a staggering 62.3% of SA's emissions in 2011.[21] Eskom Holdings State-Owned-Company (SOC) Ltd is South Africa's primary electricity supplier. It is wholly owned by the South African government, and is a public utility established in 1923.[22] Eskom generates, transmits and distributes electricity to industrial, mining, commercial, agricultural and residential customers. It also supplies municipalities; that in turn redistribute the electricity to businesses and households within their areas. Eskom's mission is to provide sustainable electricity solutions to support the growth of the economy and thus to improve the quality of life of the people in South Africa and in the SADC region.[23]

Currently, Eskom owns and operates 27 power stations in South Africa with a total nominal capacity of 41 995 MW. Eskom's generating capacity comprises of 35 726 MW from coal-fired power stations, 1 860 MW from nuclear power, 2 409 MW from gas-fired power fuelled by diesel, 2 000 MW from hydro and pumped storage stations, and 3 MW from a wind farm at Klipheuwel.[24] However, in February 2015, Klipheuwel was impaired as it had reached the end of its useful life.[25]

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19 www.economist.com/climatechangeanddevelopingcountries.
20 Eskom Integrated Report, 2014.
21 Steele 2012 *Green Peace* 4.
22 Eskom Integrated Report, 2014.
23 Eskom Corporate Plan 2015/16-2019/2020.
24 Eskom Integrated Report, 2014.
25 Eskom Corporate Plan 2015/16-2019/2020.

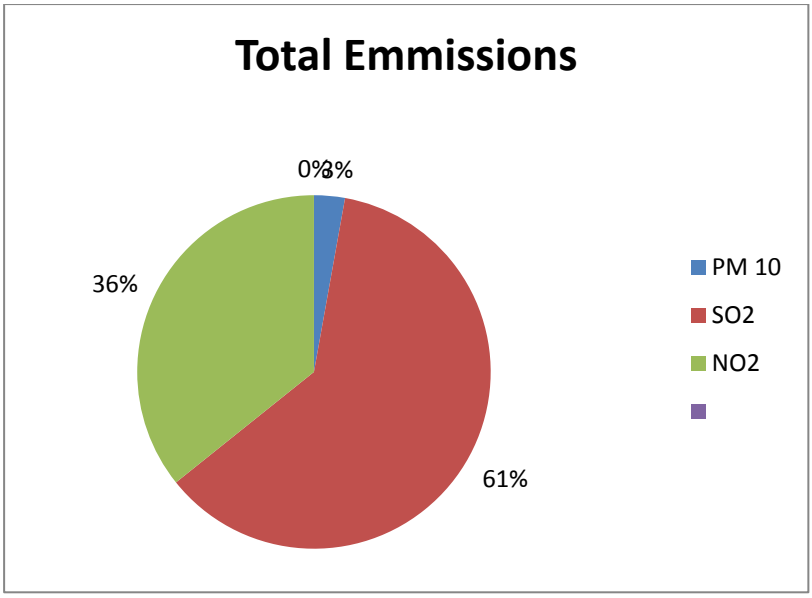

Figure 1: An estimate of the quantity of pollutants emitted into the air in South Africa in 2002[26]

Eskom's coal-fired power stations use conventional pulverised coal technology, with average thermal efficiencies of 33%, and account for around 220 Mtpa.[27] South Africa emits 2.03 kg CO_2per $GDP40 compared to a global average of 0.74 and the OECD average of 0.44 kg CO_2/$GDP.[28] South Africa export high quality coal to other countries and retain poor quality high sulphur coal for domestic use, that is also used in generating electricity with average calorific values of 4500 kcal/kg (19 MJ/kg), ash 29.5%, and sulphur 0.8%.[29] The electricity sector currently accounts for about half of South Africa's electricity's greenhouse gas emissions, and then CO_2 emissions from the power generation would need to be capped at around 275 Mtpa.[30]

Eskom has embarked on a capital expansion programme and is currently building two new power stations and major power lines to meet South Africa's growing energy demand to enable economic growth.[31] Two new units have been synchronised to the power system, i.e. Sere Wind Farm (100MW) and Medupi Unit 6 (the capacity of

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26 Scorgie *Urban air quality management and planning in South Africa* 71-73.
27 Eberhard "The future of South African coal".
28 IEA Report, 2008.
29 Eskom Annual Report, 2010.
30 Eberhard "The future of South African coal".
31 Eskom Corporate Plan 2015/16-2019/2020.

which will vary until full commercial operation, which will yield 800MW).[32] Eskom currently operates as a vertically integrated company across a value chain that supplies electricity to both South Africa and the SADC region.[33] Eskom operating as a vertically integrated company can be of disadvantage to consumers because of the lack of competition with other suppliers as they can prevent entry or create barriers of new suppliers in the market.

This chapter has given a background to electricity generation in South Africa and further outlines the social, health and environmental impacts of generating electricity using fossil fuels. The chapter provides some insight into the challenges of generating energy using coal. The current generation of energy in South Africa does not contribute to the realisation of the rights contained in section 24 of the Constitution. The chapter further provides an overview of the current energy mix in South Africa. The main focus is placed on the social, health and environmental impacts/challenges of generating electricity using coal.

2.2 Challenges and opportunities of coal

The coal sector in South Africa offers both challenges and opportunities. Just over two thirds (by mass) of domestic coal consumption are for electricity generation by Eskom, the national power utility. Coal thus plays a vital role in South Africa's energy-economy. It accounts for 70% of primary energy consumption, 93% of electricity generation, and 30% of petroleum liquid fuels. Coal production and use also result in a number of serious environmental impacts. While GHG emissions and climate change loom large in the future, a number of other coal mining related environmental problems are emerging.[34]

2.3 Social impacts of burning coal

A hundred years of coal mining in the Mpumalanga Highveld, SA's most important coalfield, has imposed a complicated "coal dynamic" on the area, resulting in

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32 Eskom Corporate Plan 2015/16-2019/2020.
33 Eskom Corporate Plan 2015/16-2019/2020.
34 Eberhard "The future of South African coal".

extensive environmental and social externalities.[35] This dynamic includes the mining itself, the generation of electricity in coal-fired power stations, some of which are serviced by captive collieries, heavy industry using coal to produce steel and alloyed products, coal hauling by truck, and a culture of indoor coal burning for heating and cooking in seasonally cold areas, which is now recognized as a major health hazard.[36]

The use of coal, both domestic and commercial (via coal fired power stations, of which the majority are situated in this area) cause air pollution.[37] DEA has attempted to identify areas of concern in terms of air quality with emphasis on district municipalities and Metropolitans.[38] The Mpumalanga province has been declared as an air quality priority area. Currently this province has amongst the worst air quality in the world, largely due to coal mining activities, uncontrollable underground fires, and power-stations burning coal.[39]

Mpumalanga has long been seen as an area of bad air quality. In the winter months, a temperature inversion layer traps pollutants in the lower atmosphere. The most recent and by far the most comprehensive study of air pollution in Mpumalanga notes that elevated pollutants are SO_2 particulates (PM10 and PM2.5), NO_X, O_3, benzene and H_2S.[40] Power generation, fuel combustion by industries and institutions, domestic fuel burning and vehicle emissions contribute to these, while significant sources of benzene include vehicle emissions, domestic coal burning and releases from the petro-chemical complex at Secunda.

Munnik[41] argues that the Mpumalanga Highveld, reported one of the worst air quality areas in the world, has 22 collieries concentrated around eMalahleni (formerly known as Witbank), and over the last 100 years of coal mining, a complicated "coal dynamic" has been imposed on the area.[42] The benefit of Eskom's electricity is largely not experienced by those that are suffering from the pollution emitted from the coal-fired power stations. Low-income households make up 25% of the population but use only

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35 Munnik "The social and environmental consequences of coal mining in South Africa" 1-24.
36 Munnik "The social and environmental consequences of coal mining in South Africa" 1-24.
37 Munnik "The social and environmental consequences of coal mining in South Africa" 1-24.
38 The National Air Quality framework, 2012
39 Munnik "The social and environmental consequences of coal mining in South Africa" 1-24.
40 Munnik "The social and environmental consequences of coal mining in South Africa" 1-24.
41 McDaid *The health impact of coal* 2-3.
42 Steele 2012 *Green Peace* 4.

2.4% of the electricity, whereas high-income households are less than half in number but use 14 times, as much and many of those poorer people live in Mpumalanga.[43]

2.4 Human health impacts of burning coal

Air pollution emissions from thermal power plants contribute to the ambient particulate matter, which is the most important environmental health risk globally, as well as to emissions of mercury, a potent neurotoxin that harms the mental development of children.[44] Some epidemiological studies found that these pollutants contribute to the incidence of mortality that is "cases of bronchitis, asthma and lung cancer, hospital admissions related to respiratory, cardiac, asthma and coronary obstructive pulmonary disease, and asthma-related emergency room visits".[45] Nitrogen oxides contribute to the depletion of the ozone layer.

In 2008 the World Health Organization (WHO) and other organizations calculated that coal particulates pollution causes approximately one million deaths annually across the world, which is approximately one third of all premature deaths related to all air pollution sources.[46] Pollutants emitted by burning coal include fine particulates (PM2.5) and ground-level ozone.

2.5 Environmental impacts of coal power stations

It is often argued that SA's significant coal dependency results in a number of serious "environmental" impacts; however, it is easy to dismiss these impacts as "environmental" in nature. Although the right to have access to an environment that is not harmful to people's health or well-being is enshrined in the country's constitution, "environmental impacts" are often viewed as necessary to allow for development, job creation and a stronger economy. The reality, however, is that it is impossible to survive without water, and all South Africans have an inalienable right of access to sufficient, clean, safe drinking water.[47]

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43 McDaid *The health impact of coal* 24-25.
44 Myllyvirta *Health impacts and social costs of Eskom's proposed non-compliance*" 1.
45 Blignaut J and Nkambule N *The external cost of coal-fired power generation* 85-91.
46 Munnik "The social and environmental consequences of coal mining in South Africa" 1-24.
47 Steele 2012 *Green Peace* 4.

SA already struggles with water scarcity, and it is predicted that the country will face a significant water crisis in the coming decade.[48] SA's water availability is rather limited, with an average annual rainfall of 497mm, which is much lower than the global average of 860mm per annum.[49] Burning coal to produce electricity is an incredibly water intensive process, with a number of serious implications for both water quantity and quality.[50] The current allocation of water to the coal mining industry and to Eskom for coal-fired electricity is not a transparent, accountable or sustainable practice.[51] Burning coal is one of the most destructive practices on the planet and the true cost of coal is environmental destruction at every step, using massive amounts of scarce water and destroying people's health and wellbeing.[52] These facts underline the inherently unsustainable nature of coal-based electricity generation. The change of government in 1994 brought changes in legislation: a constitution was adopted, and government became the custodian of all natural resources for the South African people.[53] The increased concentration of GHG (including CO_2) in the earth's atmosphere due to human activities like burning coal is causing dangerous climate change.[54] Where CO_2 is projected to have a negative impact on climate at a global level, SO_2 and NO_X impair the environment at a more local level.[55] From the foregoing facts the assumption is made that the current coal-dominated electricity generation methods in SA are not contributing to the protection of the rights contained in section 24 of the Constitution.

2.6 Conclusion

When looking at the above it is evident that coal-fired power generation has contributed to the deleterious social, health and environmental impacts associated with energy generation. It is evident that generating energy from coal has a detrimental impact on human health and the environment. There is a need of balancing the issues arising from energy generation with the social, economic and

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48 Steele 2012 *Green Peace* 4.
49 Blignaut *et al The external cost of coal-fired power generation"* 85-91.
50 Steele 2012 *Green Peace* 4.
51 Steele 2012 *Green Peace* 4.
52 Greenpeace: The True Cost of Coal in South Africa" 2-3.
53 Munnik "The social and environmental consequences of coal mining in South Africa" 1-24.
54 Greenpeace: The True Cost of Coal in South Africa.
55 Eskom Report, 2011.

environmental issues protected in the Constitution, if we are to be able to move together into a future marked by sustainable development. Balancing these issues will need legal tools to ensure environmental rights are realised.

The next chapter looks at energy sector reform. It investigate South Africa's policies and legislation pertaining to energy generation, and outline to what extent these policies, acts and regulations aim to realise energy sector reform as required in order, to fulfil the environmental right contained in section 24 of the Constitution. The chapter examines the theoretical background to the legislation to ascertain to what extent energy sector reform is embodied in these pieces of legislation.

3 Theoretical background to energy sector reform law and policy

3.1 Introduction

The central purpose of this chapter is to analyse section 24 of the Constitution as the basis for legislative measures aimed at energy sector reform. Section 24 not only provides a right to the environment, but it goes further to give the state the duty to enact law and policy aimed at realising the right to a healthy environment. This chapter focus primarily on a critical analysis of the constitutionally enshrined rights contained in section 24.

An environmental right requires the state to which it applies to refrain from activities harmful to the environment and to adopt and enforce policies promoting conservation and the improvement of the quality of the environment.[56] Secondly, it appears on several counts that the right is not purely an individual right: one may single out the rights of future generations whose interests must be taken into account but whose individual members cannot be identified, "or focus on more precise claims relating in particular to displaced indigenous peoples facing the total loss of their cultural, social and physical environment".[57]

Section 24 of the Constitution is the basis of the environmental legal framework in South Africa. Environmental law in South Africa refers broadly to an area of the law that specifically address environmental issues and more general laws that have a direct impact on environmental issues.[58] Environmental law can be divided into two major categories, namely international environmental law and national environmental law. The relationship between international environmental law and national environmental law has mainly to do with the purposes for which each of the two categories of law was created, as well as with the scope that each of the two types of law covers. International environmental law is law developed between sovereign states to develop standards at the international level and provide obligations for

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[56] Cullet 1995 *Neth QHR* 25-33.
[57] Cullet 1995 *Neth QHR* 25-33.
[58] Kurukulasuriya and Robinson *Training manual on international environmental law* 15-18.

states, including regulating their behaviour in international relations in environment-related matters.[59]

National environmental law on the other hand applies within a state and regulates the relations of citizens among one another and with the executive within the state, including the rules at the national level that protect the environment.[60] These consist of the legislation, standards, regulations, institutions and administrative measures adopted to control activities damaging to the environment. They would include *inter alia* framework environmental legislation, sectoral legislation and incidental legislation, and regulations, depending on the culture of a given country.[61] National constitutions provide a source of environmental law when they provide environmental rights for the citizens. In a number of countries the constitutional right to an environment not harmful to citizens' health has been interpreted in Court to provide redress where such an environment was lacking.[62]

There are several types of environmental laws and national legislative approaches to environmental management. These include, *inter alia*, the following:

- Constitutions,
- Sectoral laws, and
- Framework environmental laws.

Environmental problems in South Africa have undoubtedly been exacerbated by past apartheid policies.[63] Most black designated residential areas were located close to dumping sites, mines or industrial areas. Today most communities situated in these areas continue to be exposed to environmental hazards without having adequate access to essential services such as effective sanitation, quick and safe transport, and safe and healthy working environments.[64]

There is not much South African common law dealing with environmental conservation, but there are a number of common law principles that are relevant to

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59 Kurukulasuriya and Robinson *Training manual on international environmental law* 15-18.
60 Kurukulasuriya and Robinson *Training manual on international environmental law* 15-18.
61 Kurukulasuriya and Robinson *Training manual on international environmental law* 15-18.
62 Kurukulasuriya and Robinson *Training manual on international environmental law* 15-18.
63 *3rd Economic and Social Rights Report:* Environmental Rights.
64 *3rd Economic and Social Rights Report:* Environmental Rights.

environmental law.[65] The body of legislation that makes up South African environmental law is issue-specific, dealing with specific environmental issues such as the pollution of air or water, the conservation of wild life, and so on.[66]

The *Constitution of the Republic of South Africa* of 1996 is the supreme law of the country, and further operates as framework legislation within which South Africa's legislation must operate. The Constitution contains an environmental right and also allocates responsibilities to the different spheres of government in the country.[67]

3.2 Constitution of the Republic of South Africa, 1996

South Africa's legal system was brought into a new era in 1994 with the enactment of a new constitution including the Bill of Rights.[68] The Constitution came into effect on 27th of April 1994. The Constitution contains environmental rights in its chapter 2 of the Bill of Rights.

3.2.1 Environmental Right

There are two rights contained in the environmental right: the rights of human beings to a safe and healthy environment, and the rights of the environment itself not to be degraded.[69] The right of people is divided into three categories:

3.2.2 First generation or blue rights

These rights are the civil and political rights of individuals, e.g. the right to equality, the right to life, and so on. Blue rights are enjoyed by individuals without the state having to provide anything.[70]

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65 Kidd *Environmental Law* 20-36.
66 Kidd *Environmental Law* 20-36.
67 Kidd *Environmental Law* 20-36.
68 Kidd *Environmental Law* 20-36.
69 Kidd *Environmental Law* 20-36.
70 Kidd *Environmental Law* 20-36.

3.2.3 Second generation or red rights

The red rights are social, economic and cultural rights. These rights are controversial. Courts are sometimes required to enforce them, but they tend to get positive action from the state.[71]

3.2.4 Third generation or green rights

The third generation rights are referred to as people or solidarity rights. They include the right to development, environmental rights, or the right to peace. Green rights are often exercised as group rights. These are the rights of the public at large.[72] An environmental right has been incorporated into the constitutions of many states, including South Africa. The South African environmental right requires government to protect the nation's natural resources and the environment, either by declaring formal policies or by passing specific legislation. This right imposes positive obligations on the State and also to citizens - to protect and conserve the natural environment.[73] Environmental right is a fundamental human right, requiring the State to take positive steps towards the attainment of the right.[74]

The expression "Everyone has the right to an environment that is not harmful to their health or well-being" encompasses two aspects:

The right to a clean environment and sustainable development are fundamental and closely connected to the right to health and well-being.[75] It is of fundamental importance to note that there is a strong connection between the quality of the environment and the health of the people living in an environment.[76]

Environmental protection is of prime importance in this clause, being set as one of the main objectives and constitutional obligations of the State.[77] The responsibility of the State is extended to safeguarding future generations, for whom the State is

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71 Kidd *Environmental Law* 20-36.
72 Kidd *Environmental Law* 20-36.
73 Kidd *Environmental Law* 21-22.
74 Kidd *Environmental Law* 21-22.
75 Kurukulasuriya and Robinson *Training manual on international environmental law* 15-18.
76 Environmental Rights – Period: April 2000-March 2002.
77 Kidd *Environmental Law* 21-22.

accountable in this context. Subsection (a) of section 24 provides that "everyone has the right to an environment that is not harmful to their health or well-being". Subsection (b) of section 24 has a socio-economic character as it imposes a constitutional imperative on the State to secure the right of individuals to have the environment protected, for the benefit of present and future generation, through reasonable legislative and other measures that:

(i) *prevent pollution and ecological degradation;*

(ii) *promote conservation; …*

secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development. The domestic environmental laws of all countries, South Africa included, have been profoundly influenced by international law.[78]

The responsibility for the provision of a safe and healthy environment is outlined in a range of legislation and different sections of the Constitution.[79] The Bill of Rights, Chapter 2 of the Constitution, makes provision for environmental issues and places an obligation in terms of sections 152(1) (b) and (d) on local government as stipulated in sections 4(2) (d) and 4(2) (i), 73(1) and (2) of the *Municipal Systems Act* 32 of 200 to ensure that the right to a clean and healthy environment is fulfilled.[80]

The right to a healthy environment contained in subsection (a) of the environmental clause extends health rights beyond section 27(1) of the Bill of Rights, which is limited to the provision of health care services.[81] A particular environment may be damaging to people's health yet may not necessarily infringe people's right to health care services. Therefore, for example if atmospheric pollution or the placement of disposal sites is to be subjected to constitutional challenge on the grounds that people's health is being damaged, the challenge would have to be brought in terms of the environmental clause and not in terms of section 27. Another important aspect of the right created by section 24(a) is the right to an environment "that is not harmful to individuals' health and their wellbeing". A person's well-being is harmed if his/her

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78 Glazewski *Environmental Law in South Africa* 29.
79 Environmental Rights – Period: April 2000-March 2002.
80 Environmental Rights – Period: April 2000-March 2002.
81 *3rd Economic and Social Rights Report:* Environmental Rights.

health is harmed. If the environment harms one's interests and those interests are not protected elsewhere in the Constitution, one would use the environmental clause to seek redress.[82]

Subsection (b) of the environmental clause has a socio-economic character and also imposes a constitutional imperative on the State to secure the rights of individuals through reasonable legislative and other measures. It further goes on to state that pollution and ecological degradation need to be prevented and that conservation needs to be promoted. Where pollution matters are concerned, this could be achieved through protecting the least impacted systems first, as this will be cost-effective and then addressing the problem of the more impacted or polluted systems at a later stage. The Grootboom case stated that what constitutes reasonable legislative and other measures had to be determined in the light of the fact that the Constitution created different spheres of government, namely the national, provincial and local.[83]

One of the greatest challenges facing South Africa and the rest of the world is to improve the quality of human life for both the present and future generations through sustainable development.[84] The principle of the sustainability of the environment encompasses the notion of inter-generational equity, that is, that harm to the environment affects the present as well as future generations.[85]

Environmental rights pose a major challenge globally and South Africa is no exception to the rest of the nations of the world.[86] All countries, especially developing countries, are faced with the major challenge of ensuring that there is balance between environmental rights and economic development. Human rights cannot be fully realised within a degraded or polluted environment. Linking economic development with environmental rights creates a rights-based approach to environmental protection that places the people harmed by environmental degradation at its centre.[87]

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82 *3rd Economic and Social Rights Report:* Environmental Rights.
83 *3rd Economic and Social Rights Report:* Environmental Rights.
84 Environmental Rights – Period: April 2000-March 2002.
85 Environmental Rights – Period: April 2000-March 2002.
86 *3rd Economic and Social Rights Report:* Environmental Rights.
87 *3rd Economic and Social Rights Report:* Environmental Rights.

3.3 Conclusion

It is evident from the above that an environmental right requires States to refrain from activities harmful to the environment and to adopt and enforce policies promoting conservation and the improvement of the quality of the environment. But the challenge remains that the Government needs to provide resources to people, including electricity, of which its generation relies mainly on fossil fuels which therefore infringe environmental rights or have an impact on human health and the environment. Therefore the right to a of life expressed in section 9 of the Constitution and the right to a healthy environment expressed in section 24 have to be promoted simultaneously and reconciled through the provision of sustainable development that does not impair the quality of the South African environment.

The following chapter is going to discuss the law and policies addressing the duty placed on the state in terms of section 24, in order to ascertain to what extent energy sector reform is embodied in them. Secondly, the chapter further examines to what extent energy sector reform as prescribed by the law and policy works towards realising the right to a healthy environment as contained in section 24.

4 SA energy law and policy pertaining to energy sector reform

4.1 Introduction

South Africa had a range of laws that regulated the environment in the period before the democratic Constitution was adopted. Some of the most important of these were the *Water Act*, the *Atmospheric Pollution Prevention Act*, the *Mining Rights Acts*, the *Health Act*, the *Hazardous Substances Act* and the *Environmental Conservation Act*. Although there was relevant legislation prior to democratic SA, the environment and the people living in the environment were not adequately protected.[88]

As discussed in the previous chapters, from the environmental perspective one of the biggest changes brought about by the constitutional dispensation was the inclusion of the environmental right into the Bill of Rights. Section 24 embodies the imperatives and constitutional mandate for environmental compliance and enforcement.[89] The primary legislation governing air quality is the Constitution, specifically section 24 which states that everyone has the right to an environment (including ambient air) that is not harmful to their health and well-being. In line with its constitutional duty in terms of section 24(b), the legislature has enacted a range of statutes that attempt to protect the environmental resources and regulate the harmful impacts of human activity on the environment.

In working towards an answer to the research question of this study, this chapter will investigate current SA energy law and policy to identify what objectives these documents contain with reference to energy sector reform. The chapter will examine to what extent is legislation and policies attempts to ensure that the rights contained in section 24 are protected in relation to energy generation. A series of specific national policies and laws will be looked at. The remainder of the chapter will discuss the objectives of the various pieces of legislation and policies to be found in the area of concern. The pieces of legislation and/or policies to be discussed are: the White Paper, 1998; the White Paper, 2003; the Energy Act, 2008; the National Development Plan, 2030; the National Environmental Management Act (NEMA); the White Paper on

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88 Paterson A and Kotzé J (ed) *Environmental compliance and enforcement in SA*.
89 Paterson A Kotzé J (ed) *Environmental compliance and enforcement in SA*.

Renewable Energy of the Republic of South Africa; and the Energy Efficiency Strategy of the Republic of South Africa, 2005. Also general pieces of environmental legislation such as NEMA, as the framework environmental legislation, and the National Environmental Management Air Quality Act (NEM: AQA) will be discussed to the extent to which they are relevant to the central research question.[90] The legislation that will be discussed is not the only environmental legislation in South Africa, but the study will focus only on the legislation that pertains to air quality/atmospheric pollution and renewable energy. The legislation that will be discussed in this chapter is whatever is relevant to answering the research question.

The chapter place a great deal of emphasis on the objectives and vision of the National Development Plan 2030 (NDP) and various other pieces of legislation as well as the White Paper on Energy, and NEM: AQA. After these policies have been discussed, the paper will delve into some barriers of energy law, compare the renewable energy options available for South Africa, and thereafter draw to a conclusion on these issues.

4.2 Background to the SA energy legal framework

When considering the country's energy policies, it is best to consider three different periods, the first being the period of the apartheid regime, from 1948 up to 1994; the second being the period following the first democratic elections of 1994 and up to 2000; and the third from 2000 onwards, after the euphoria of the new dispensation had started to recede. The energy policies of all three periods differed, but all contributed to the growth of the sector. During the apartheid period, due to the political isolation of the country, energy policies were mostly centred on energy security. After the advent of democracy, energy policies were directed to addressing the injustices faced by the majority of the population, who had previously been denied basic services. Equity and justice were therefore the primary goals.[91] After the 1994 elections the government was determined to provide basic services to the poor and

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90 This list of environmental laws is not exhaustive, but the limited scope of this study prohibits attempting to deal with a more extensive list. Those to be discussed pertain specifically to the energy sector.

91 Davidson *et al Sustainable energy in sub-Saharan Africa* 2.

disadvantaged majority of South Africans, and electricity was considered to be one of the main components of such services.[92]

Recent years have seen a remarkable development of environmental law in South Africa. Government, to its credit, has enacted wide-ranging legislation that essentially aims to place the provisions of section 24 of the Constitution on a statutory footing. As already noted in the previous chapter, section 24 contains, among other provisions, directive principles which impose duties on government to protect the environment for present and the future generations through reasonable legislative and other measure.[93] Environmental protection is intrinsically related to a number of other human rights and comes out as both a precondition and an outcome of the enjoyment of many rights.[94]

For government to actually achieve its constitutional mandate of ensuring that the environment is protected through legislative and other measures, it will need not only to legislate but also to ensure compliance with the legislation, presumably through enforcement. Certain state departments are responsible for ensuring that the right to a clean and healthy environment is realised through compliance and enforcement. The following departments have a mandate to protect South African citizens' rights to a healthy and clean environment: the national Department of Environmental Affairs; the Department of Water and Sanitation; the Department of Agriculture, Forestry and Fisheries; the Department of Minerals and Energy; the Department of Health; the Provincial departments of the Environment; and local government.[95] South Africa has both sectoral legislation and framework environmental legislation that is NEMA, to rely on in this context.[96]

4.3 National Environmental Management Act (NEMA), 1998

NEMA is framework environmental legislation that provides the legal and institutional framework for environmental management without seeking to legislate comprehensively. It established a new form of environmental regulation and

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92 Davidson *et al Sustainable energy in sub-Saharan Africa* 2.
93 Cullet 1995 *Neth QHR* 25-33.
94 Cullet 1995 *Neth QHR* 25-33.
95 Environmental Rights – Period: April 2000-March 2002.
96 Kurukulasuriya and Robinson *Training manual on international environmental law* 15-18.

environmental governance in South Africa.[97] It was developed in response to the deficiencies inherent in the sectoral approach to environmental management, and represents an integrated, ecosystem-oriented legal regime that permits a holistic view of the ecosystem, the synergies and interactions within it, and the linkages in environmental stresses and administrative institutions.[98] NEMA aims to define overarching and generic principles in which sector-specific legislation is embedded, to enhance co-operative environmental governance among fragmented line ministries and to provide for a broad, flexible framework to address environmental issues and to respond to any changes in the prevailing social, economic and ecological parameters.[99]

The courts have had to take a variety of decisions in terms of NEMA. One of the first decisions pertained to the need to provide a healthy environment, in *Minister of Health and Welfare v Woodcarb (Pty) Ltd*.[100] The Minister of Health brought an interdict against Woodcarb under the *Atmospheric Pollution Prevention Act* (APPA), based on complaints received about smoke emissions from Woodcarb's sawmill plant. Woodcarb had violated section 29 of the interim Constitution, the right to an environment that is not detrimental to health or well-being.

Hichange Investments (Pty) Ltd v Cape Produce Company (Pty) Ltd t/a Pelts Products[101] had to do with a company that was producing a number of chemical waste products. The applicant alleged that the noxious gases caused a foul, offensive odour and the corrosion of metal structures. The company was found to be violating section (28) (1) of NEMA, the Duty of Care. In considering the applicability of section 28(1) and section (28)(4) of NEMA, Ledch J referred to the concepts of health and well-being in section on 24 of the Constitution, and the need to assess whether or not the pollution amounted to "significant" pollution, as required by section 28(1). The ruling was based on section 24 of the Constitution and linked this emission of pollution to the physical discomfort of those who lived and worked in the area, and hence reached the

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97 Paterson A and Kotzé J (ed) *Environmental compliance and enforcement in SA*.
98 Kurukulasuriya and Robinson *Training manual on international environmental law*15-18.
99 Kotzé *Environmental compliance and enforcement in SA*.
100 1996 3 SA 155 (N).
101 2004 2 SA 393 (E).

conclusion that the well-being of the people in the area was being compromised by such pollution.[102]

The environmental clause has further been concretised in the set of environmental management principles which underpin the *National Environmental Management Act* (NEMA) 107 of 1998.[103] Sectoral legislation addresses specific aspects of the environment and human activity. Thus, there are laws on water, land and energy, and laws establishing national parks or controlling factories.[104] The sectoral legislation that is of focus of this chapter will be the *National Environmental Management: Air Quality Act* and other policies relevant to achieving energy reform in South Africa.

4.4 White Paper on Energy Policy of the Republic of South Africa (1998)

The Constitution further requires Government to establish a national energy policy in order:

- to ensure that national energy resources are adequately tapped and delivered;
- to cater for the needs of the nation; and
- to ensure that the production and distribution of energy are sustainable and lead to an improvement in the standard of living of citizens.[105]

The Government's overarching energy policy has been set out in its *White Paper on Energy Policy of the Republic of South Africa*.[106] The Government's overall vision for the role of renewable energy in its energy economy is to create an energy economy in which modern renewable energy increases its share of the energy consumed and provides affordable access to energy throughout South Africa, thus contributing to sustainable development and environmental conservation.[107]

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102 Paterson A and Kotzé J (ed) *Environmental compliance and enforcement in SA*.
103 *3rd Economic and Social Rights Report:* Environmental Rights.
104 Constitution.
105 *White Paper on the Renewable Energy Policy of the Republic of South Africa*.
106 *White Paper on the Renewable Energy Policy of the Republic of South Africa*.
107 *White Paper on the Renewable Energy Policy of the Republic of South Africa*.

4.5 White Paper on Renewable Energy (2003)

This *White Paper on Renewable Energy* (hereinafter referred to as the White Paper) supplements the Government's overarching policy on energy as set out in its *White Paper on the Energy Policy of the Republic of South Africa,* which pledges "Government support for the development, demonstration and implementation of renewable energy sources for both small- and large-scale applications".

The need and urgency for a White Paper on Renewable Energy has its basis in the World Summit on Sustainable Development (WSSD): Johannesburg Plan of Action (CSD-11, 2002):

> Diversify energy supply by developing advanced, cleaner, more efficient, affordable and cost-effective energy technologies, including fossil fuel technologies and renewable energy technologies,. With a sense of urgency, substantially increase the global share of renewable energy sources with the objective of increasing its contribution to total energy supply, recognizing the role of national and voluntary regional targets.

4.5.1 Vision of the White paper

Government's overall vision for the role of renewable energy in its energy economy is:

> An energy economy in which modern renewable energy increases its share of energy consumed and provides affordable access to energy throughout South Africa, thus contributing to sustainable development and environmental conservation.

4.5.2 Purpose of the Policy

- The purpose of this White Paper is to set out Government's principles, goals and objectives for renewable energy.
- It furthermore commits Government to a number of enabling actions to ensure that renewable energy becomes a significant part of its energy portfolio over the next ten years.
- It is intended to give a much needed thrust to renewable energy.

- The policy envisages a range of measures to bring about the integration of renewable energies into the mainstream energy economy.[108]

For Government to achieve this aim of the White Paper, it is setting as its target 10 000 GWh (0.8 Mtoe) of renewable energy as a contribution to total energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro.[109]

The White Paper recognises that the African continent is endowed with an abundance of renewable energy resources: hence it's being published to ensure that the renewable energy resources are used optimally. The present worldwide trend towards the utilisation of environmentally sustainable energy is a response to global climate change. This, coupled with market incentives to promote renewable energy technologies, can make this trend a reality in South Africa. The White Paper also notes that the large-scale utilisation of renewable energy will reduce the nation's emissions of carbon dioxide, thus contributing to an improved environment both locally and worldwide.

The sources of renewable energy to be utilised for power generation and non-electric technologies are such as solar energy and bio-fuels. These would make up approximately 4% (1667 MW) of the projected electricity demand for 2013 (41539 MW). Government intends to strategically develop the renewable energy resources in the future in a systematic way, thus contributing positively to the South African economy and to the stability of the global environment. This will involve changing the basic framework of how energy is produced, sold, traded, transferred and bought. The long-term goal is the establishment of a sustainable, renewable energy industry with an equitable BEE share and job market that will offer in future years a fully sustainable, non-subsidised alternative to fossil fuel dependence. [*White Paper on the Renewable Energy Policy*]

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108 *White Paper on the Renewable Energy Policy of the Republic of South Africa*.
109 *White Paper on the Renewable Energy Policy of the Republic of South Africa*.

4.6 Climate Change Response Strategy (2004)

The Climate Change Response Strategy, which was launched in October 2004, outlines the framework of how South Africa should respond to climate change. Although there will be costs associated with South Africa's adaptation and GHG emission reduction efforts, there will also be significant short- and long-term social and economic benefits, including improved international competitiveness, that will result from a transition to a lower-carbon economy and society.

The policy states that South Africa will build the climate resilience of the country, its economy and its people, and manage the transition to a climate-resilient, equitable and internationally competitive lower-carbon economy and society in a manner that simultaneously addresses South Africa's over-riding national priorities for sustainable development, job creation, improved public and environmental health, poverty eradication, and social equality.[110] Policy decisions on new infrastructure investments must consider climate change impacts to avoid the lock-in of emissions-intensive technologies into the future. This was evident as one of the conditions during Eskom loan application to build new power stations - Medupi. Eskom was supposed to invest in cleaner technology or move towards renewable energy as one of the conditions. Moving towards renewable energy will be a step towards energy reform in South Africa, which is sorely needed.

4.7 National Environment Management: Air Quality Act of 2004 (NEM: AQA)

The *National Environment Management: Air Quality Act* (2004) reformed the law regulating air quality in order to protect the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development; to provide for national norms and standards regulating air quality monitoring, management and control by all spheres of government; for specific air quality measures.[111]

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[110] Climate Change Response Strategy.
[111] DEAT Report 14th session of the United Nations Commission of Sustainable Development.

NEM: AQA generally accepts that air quality is fundamentally linked to health. The constitutional entitlement of South Africans to an environment which is not harmful to people's health and well-being is pertinent in the context of air pollution.[112] NEM: AQA reformed the law regulating air quality in order to protect the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development.

NEM: AQA aims to:

(a) prevent pollution and ecological degradation;
(b) promote conservation; and
(c) secure the ecologically sustainable development and use of natural resources[113]

South Africa does not have a national air quality problem, although a number of air pollution "hot spots" exist around the country where severe air quality problems occur. The Air Quality Act contains specific provisions to deal with these problem areas, the so-called "Priority Area" provisions. Currently, industrial emissions are regulated by the Chief Air Pollution Control Officer (CAPCO) of the DEA, which states the actual quantity of particulate emissions that may be emitted as well as the level of emission allowed.[114]

NEM: AQA acknowledges that:[115]

- Many areas of the Republic are not conducive to a healthy environment for people,
- the burden of health impacts associated with polluted ambient air falls most heavily on the poor,
- air pollution carries a high social, economic and environmental cost that is seldom borne by the polluter of atmospheric emissions of ozone-depleting substances,

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112 Glazewski *Environmental Law in South Africa* 581-583.
113 South Africa Country Report*: Atmospheric Pollution and Climate Change.*
114 South Africa Country Report*: Atmospheric Pollution and Climate Change.*
115 South Africa Country Report*: Atmospheric Pollution and Climate Change.*

- green-house gases and other substances have deleterious effects on the environment locally, regionally and globally.

NEM: AQA aims to regulate air quality in South Africa in order for air quality regulation to be aligned with section 24(b) of the Constitution.[116] It also provides for national norms and standards regulating air quality monitoring, management and control by all spheres of government.[117] The Act also has offences and penalties which are not to exceed 10 years imprisonment and a maximum fine of up to R10 million rand.

The local government obligation imposed by NEM: AQA include that the Local authorities should generally seek to protect and enhance the quality of air in accordance with the NEMA environmental principles, abide by national norms and standards regulating air quality, prevent air pollution and the degradation of air quality, reduce discharges, promote air quality effectively, regularly report on air quality, and comply with the related international law obligations, like UNFCCC.[118] A municipality may furthermore in terms of bylaw identify substances or mixtures of substances in ambient air which present a threat to health, well-being or the environment in the municipality, or which they believe present such a threat, and establish local standards of emission from point, non-point or mobile sources in the municipality.

4.7.1 Developments and project initiative under NEM: AQA

Under this Act an important standard for air quality (SANS 1929) was published in January 2005. The standard gives limit values for common air pollutants to ensure that the negative effects of such pollutants on human health are prevented or reduced.[119]

4.7.2 SO_2 ambient standard setting initiative

The initiative was completed in 2002 with the publication of a new APPA SO_2ambient guideline. This "guideline" is now an interim ambient air quality standard in terms of

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116 Du Plessis *Fulfilment of South Africa's Constitutional Environmental Right* 285-286.
117 South Africa Country Report*: Atmospheric Pollution and Climate Change.*
118 Du Plessis *Fulfilment of South Africa's Constitutional Environmental Right* 285-287.
119 South Africa Country Report*: Atmospheric Pollution and Climate Change.*

NEM: AQA and the process of establishing the standard has provided a possible model for the development of future air quality standards.[120]

4.7.3 SABS standard setting initiative

This project was completed in 2004 with the publication of SANS 1929, which provides ambient air quality limit values for a number of priority pollutants. These limit values are likely to replace the interim ambient air quality standards in terms of NEM: AQA and, as above, this project has provided another possible model for the development of future air quality standards.

4.7.4 Air quality management measures

Air quality management measures provide that the activities need to be licensed. Air quality management measures will centre on the listing and licensing of activities, which is provided in section of 21 and section 22 of the AQA. The Act further states that no listed activity may be conducted without an atmospheric emission licence, which can be provisional or final, prior to listing the consultation procedure referred to in paragraph.[121]

A key implementation instrument contemplated by the Act is Environmental Impact Assessment (EIA). EIA is a planning tool to assess possible significant impacts before an activity is authorised. The Act provides for an air quality officer, who may require any person involved in an activity to submit an atmospheric impact report, if there is a suspicion that the activity has contravened or failed to comply with any licence conditions under the EIA.[122]

4.7.5 NEM: AQA and local municipalities' obligations

A municipality

Must designate an air quality officer for co-ordinating matters pertaining to air quality management in the municipality, including IDP's and air quality management plans;

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120 South Africa Country Report: *Atmospheric Pollution and Climate Change.*
121 Glazewski *Environmental Law in South Africa* 601-604.
122 Glazewski *Environmental Law in South Africa* 601-604.

- Must assist the national and provincial government in the drafting of a priority area air quality management plan;
- Must take heed of a nationally and provincially published list of activities which result in atmospheric emissions with a detrimental effect on the environment; and
- Must implement an atmospheric emissions licensing system and perform the functions of a licensing authority.

Although air pollution is listed as a schedule 4(b) local government matter in the Constitution, pollution control generally is a schedule 4(a) functional area of national and provincial government, which obliges the latter to remain involved in air quality management across South Africa.[123]

4.8 National Development Plan (NDP) 2030: Key Policy Issues

The NDP acknowledges that coal will continue to be the dominant fuel in South Africa over the next 20 years. Internationally SA ranks fifth as a coal producer and exporter[124]. Cleaner coal technologies will be supported through research and development investments and technology, and gas deposits will be explored as a viable alternative to coal and nuclear power. The substitution of gas for coal would help cut South Africa's carbon intensity and greenhouse gas emissions.[125]

The NDP acknowledges that there is a need to balance supply security, affordability and climate change mitigation aspirations in the power sector. The South African plan needs to balance decarbonisation of the power sector and the increased use of new and renewable energy technologies, and reassess the desirability of nuclear power investments.[126] According to the Integrated Resource Plan, more nuclear power plants will need to be commissioned from 2023/2024. The move towards "clean" energy is a critical one that ensures that a smaller contribution is made towards the catastrophic climate change situation.[127] Relying more on cleaner energy generation is also important as it becomes increasingly unreliable to depend on coal for energy generation.

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123 Du Plessis *Fulfilment of South Africa's Constitutional Environmental Right* 285-287.
124 *National Development Plan* 2030
125 *National Development Plan* 2030
126 *National Development Plan* 2030.
127 *National Development Plan* 2030

4.9 Energy Efficiency Strategy of the Republic of South Africa, 2005

The Draft Energy Efficiency Strategy of the Republic of South Africa is the first Energy Efficiency Strategy for South Africa. It is a consolidated Governmental document geared towards the development and implementation of energy efficiency practices in this country.[128] The Strategy takes its mandate from the *White Paper on Energy Policy*, published in 1998, and links energy sector development with national socio-economic development plans.[129] The Strategy sets a national target for energy efficiency improvement of 12% by 2014.[130]

Vision

- To encourage sustainable energy sector development and energy use through efficient practices,
- To minimise the undesirable impacts of energy usage upon health and the environment,
- To contribute towards secure and affordable energy for all.

4.10 Energy Efficiency Strategy Goal 1

The goal aims to improve the health of the nation by reducing the atmospheric emission of harmful substances such as oxides of sulphur, oxides of nitrogen, and smoke, which have an adverse effect on health and are frequently a primary cause of common respiratory ailments.[131] The document notes that health benefits can be realised through reduced atmospheric pollution and improved living conditions, in particular a reduction in respiratory-related pollutants. Reforming the energy sector and moving towards renewable energy would improve the health of the people.

4.11 Energy Efficiency Strategy Goal 4: Reduction in environmental pollution

The goal is to reduce environmental pollution, which can be achieved through greater energy efficiency and the reduction of the local environmental impacts of its production

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128 *Draft Energy Efficiency Strategy of the Republic of South Africa*.
129 *Draft Energy Efficiency Strategy of the Republic of South Africa*.
130 *Draft Energy Efficiency Strategy of the Republic of South Africa*.
131 *Draft Energy Efficiency Strategy of the Republic of South Africa*.

and use. The strategy goals realise that reducing CO_2 emissions is one of the most cost-effective methods of reducing Greenhouse Gas emissions, and thereby combating climate change. To achieve this goal there is a need to move towards renewable energies/cleaner technologies. This goal further aims at reducing environmental atmospheric pollutant levels, and at reducing fossil fuel combustion at power stations. For this goal to be achieved there has to be an investment in cleaner technologies in South Africa.

4.12 Goal 5: Reduce CO_2 emissions

Energy efficiency is one of the most cost-effective methods of reducing greenhouse gas emissions, and thereby combating climate change. Addressing climate change opens the door to utilising novel financing mechanisms, such as the Clean Development Mechanism, to reduce CO_2 emissions. The reduction of national CO_2 emissions reduced by improving energy efficiency across all economic sectors would be advantageous as South Africa needs to reduce greenhouse gas emissions. South Africa is a signatory to UNFCCC; therefore it has a duty to reduce emissions that are responsible for climate change.

The strategy realises that there is a need for energy sector reform in South Africa. When one looks at goals one, four and five it is evident that the aim is to reduce greenhouse gas emissions in order to promote health.

There are various promulgated pieces of legislation with the intention of implementing the principles of Energy White Paper of 1998. With regard to electricity, the following acts deals with energy generation.

4.13 Electricity Regulation Act of 2006

The Electricity Regulation Act of 2006 outlines a new electricity regulatory framework. The Energy Act of 2008 was promulgated to provide a broader framework for integrated regulation of the electricity (and other energy carriers) and its related primary energy sources. The Act determines that when new generation capacity is required it must be attained through renewable energy sources. The first requirement

of new generation capacity is 3725 MW, and an additional 3200 MW determination is in progress.[132]

4.14 National Energy Act 34 of 2008

The *National Energy Act* is framework legislation which empowers the Minister to adequately execute certain initiatives to achieve the security of supply. This is the primary legislative instrument that governs the evolution and transformation of the South African energy economy. It seeks to ensure that diverse energy resources are available in sustainable quantities and at affordable prices to the South African economy in support of economic growth and poverty alleviation.

It states that:

> The vision of the Act is to achieve a transformed and sustainable energy sector with universal access to modern energy carriers for all by 2014.

The objectives of the Act include but are not restricted to facilitating investment in the electricity supply industry; promoting the use of diverse energy sources and energy efficiency; promoting competitiveness and customer and end-user choice; and facilitating a fair balance between the interests of customers and end users, licensees, investors in the electricity supply industry, and the public.

The Act also aims at*:*

- Improving our energy mix by having 30% of clean energy by 2025.

4.14.1 Objectives of the Act

- To ensure that diverse energy resources are available in sustainable quantities and at affordable prices.
- To develop the South African economy in support of economic growth and poverty alleviation, taking into account environmental management requirements, international commitments and obligations and interactions amongst economic sectors.

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[132] *Renewable Energy Resource Assessment in South Africa.*

- To establish institutions to be responsible for the promotion of the efficient generation and consumption of energy, energy modelling and planning, increased generation and consumption of renewable energies, and energy research.[133]

4.14.2 Strategic objectives of the Energy Act

The Act's vision will be achieved through the following strategic objectives:

- The development of effective legislation, policies and guidelines, and the encouragement of investment in the energy sector;
- The diversification of the energy mix, the improvement of access and connectivity, the provision of quality and affordable energy, the promotion of the safe use of energy, and the transformation of the energy sector;
- The development of enabling policies, and the encouragement of energy-efficient technologies;
- The promotion of clean energy alternatives, the encouragement of economic development, the promotion of job creation; and
- The facilitation of the implementation of renewable energy, energy efficiency-technologies and also the promotion and regulation of the Clean Development Mechanism (CDM) activities.

When looking at the above Act, it is evident that the Energy Act is looking towards energy diversity and moving towards renewable energy. Clearly energy policies are driving towards cleaner energy alternatives and an energy mix of which about 30% should be renewable energy by year 2025. If South Africa could implement the objectives of these Acts, clearly the energy sector would reform, though this would need to take place within the limits of the capacity, resources and financial constraints of South Africa as a developing country.

4.15 National Energy Act Strategic Plan 2010/11 – 2012/13

The National Energy Act strategic plan seeks to deliver results in terms of eight strategic objectives, however for the purpose of this paper four objectives that relate to energy sector will be discussed, that include promoting energy security through

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[133] National Energy Act 34 of 2008

reliable, clean, and affordable sources; universal access to energy sources; transformation of the energy sector; and strengthening the operations and management of the Department.

The following objectives are applicable to energy sector reform:

- ***Achieve universal access and transform the energy sector*** – diversify the energy mix, improve access and connectivity, provide quality and affordable energy, promote the safe use of energy, and transform the energy sector.
- ***Regulate the energy sector –*** develop effective legislation, policies and guidelines, encourage investment in the energy sector, ensure compliance with legislation.
- ***Optimal utilisation of energy resources*** – develops enabling policies, encourage energy efficient technologies.
- ***Ensure sustainable development*** – promote clean energy alternatives, encourage economic development, promote job creation.

The strategic objectives of the *National Energy Act* are seeking to reform the energy sector through developing effective legislation, policies and guidelines. This will be achieved through effective policies and legislation that need to encourage investment in the energy sector and ensure compliance with legislation. When looking at these goals, they aim to set guidelines that are applicable to energy sector reform.

4.16 Integrated Resource Plan (IRP 2010)

In 2010 the Department of Energy drafted an integrated resource plan (IRP 2010) which explicitly outlines the government objectives to develop 17.8GW of renewable energy, 8.4GW of which shall be via solar energy technologies. The Integrated Resource Plan (IRP) is a 20-year electricity plan which was promulgated in May 2011 pursuant to Cabinet approval in March 2011. It was first introduced as the Integrated Resource Plan 1 (IRP1) in 2009; a second draft version was released in October 2010 (the Revised Balanced Scenario (RBS)) and was open for comments for 60 days.

The primary objective of the IRP is to determine South Africa's long-term electricity demand and to detail how this demand should be met in terms of generating capacity, type and cost.

The policy-adjusted IRP's principle amendments include:

- The installation of renewables (solar PV, CSP and wind) has been brought forward in order to accelerate a local industry;
- It allows for cost optimization on imported hydro options leading to a reduction compared to the RBS;
- Recent developments with respect to prices for renewables

4.16.1 Objectives and Scope of the IRP 2010

The objective of the IRP is to develop a sustainable electricity investment strategy for South Africa over the next 20 years. The strategy encompasses both implications from demand-side management and pricing as well as capacity provided by generators.

The intent of the IRP is to:

- Improve the reliability of electricity generation;
- Ascertain South Africa's capacity investment needs;
- Consider the environmental impact and the effect of renewable energy technologies; and
- Provide a framework for Ministerial determination of new generation capacity.

IRP is in line with other energy policies in South Africa in considering energy reform by generating electricity using renewable technologies.

4.17 Integrated Resource Plan for Electricity (IRP) 2010-2030

The IRP lays out the proposed new generation build fleet for South Africa for the period 2010 to 2030. This scenario was derived based on the cost-optimal solution for new build options (considering the direct costs of new build power plants). In addition to all existing and committed power plants, the RBS includes a nuclear fleet of 9, 6 GW; 6, 3 GW of coal; 11, 4 GW of renewables; and 11, 0 GW of other generation sources.

IRP represents an appropriate balance between the expectations of different stakeholder considering a number of key constraints and risks, for example:

a) Reducing carbon emissions;
b) New technology uncertainties such as costs, operability, lead time to build etc.
c) Water usage;
d) Localisation and job creation;
e) Southern African regional development and integration; and
f) Security of supply.

4.17.1 Policy Issue 1: Nuclear options

The scenarios indicate that the future capacity requirement could, in theory, be met without nuclear, but that this would increase the risk to security of supply (from a dispatch point of view and being subject to future fuel uncertainty).

Three policy choice options re identified:

- Commit to the nuclear fleet as indicated in the RBS;
- Delay the decision on the nuclear fleet indefinitely (and allow alternatives to be considered in the interim);
- Commit to the construction of one or two nuclear units in year 2022-24, but delay a decision on the full nuclear fleet until higher certainty is reached on future cost evolution and risk exposure both for nuclear and renewables.

4.18 SA and Nuclear Energy Policy

South Africa's DoE adopted the *Nuclear Energy Policy* that was promulgated in June 2008, and declared that South Africa would reach a point of no return on its energy-building programme in early 2013.[134] Eskom has favoured a nuclear expansion programme in South Africa since the end of Apartheid in 1994. The South African Government has leveraged its position in recent years within numerous multilateral organisations such as, for example, the African Union (AU), the New Partnership for Africa's Development (NEPAD), the UN and particularly the BRICS economic grouping. BRICS was formed to create a new global order as a counterweight against Western preponderance, and has been of particular importance to South Africa as BRICS members together wield considerable influence on nuclear issues, as members of the IAEA Board of Governors.[135]

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[134] Gilbert 2013 http://www.consultancyafrica.com
[135] Gilbert 2013 http://www.consultancyafrica.com.

The different policies discussed above make it clear that the country needs to move towards renewable energy. The table below outlines the different types of renewable energies available for South Africa. Due to environmental impacts and energy capacity produced from each of the renewable energy it is evident that nuclear energy will be the best energy option to reform the energy sector in South Africa. South African developments towards renewable energies and nuclear energy will be discussed below.

4.19 Developments towards cleaner technologies

Eskom's establishment of the Renewable Energy Business Unit (REBU) in 2011 was to ensure the roll-out of RE technologies throughout Eskom and South Africa at large. Kendal Power Station, a 23 year-old 6 x 686 MW, was earmarked as a pilot of a 620kW Photo Voltaic Solar Plant, as an indication of Eskom's commitment to Government's IRP 2010, while at the same time reverting to the loan agreement. Eskom's establishment of the Renewable Energy Business Unit (REBU) was to ensure the roll-out of RE technologies throughout Eskom and South Africa at large. This makes solar photovoltaic a viable option for a renewable energy source.[136]

South Africa has been involved in many nuclear energy related agreements, which include agreements with Algeria, Argentina, China, the European Atomic Energy Community (EURATOM), Russia, South Korea and the United States (US).[137] The involvement of South Africa in nuclear research will be important if South Africa needs to reform the energy sector by moving towards the use of nuclear energy in its electricity generation. Using nuclear will have fewer impacts on the environment as compared to the use of fossil fuels in electricity generation. Generating electricity using nuclear energy would definitely transform the energy sector. There would be no greenhouse gas emissions into the atmosphere from such power stations, which would be a way of working towards realising the environmental protection enshrined in section 24 of the Constitution.

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136 Van Gelder and Spaargaren *Financing of Kusile and Medupi power plants*.
137 Gilbert 2013 http://www.consultancyafrica.com.

The country has very large coal deposits, small hydro potential and very small deposits of Gas (exploration for natural gas off the South African west coast is underway, indications of the presence of natural gas have not yet been quantified).[138] Renewable energy sources, other than biomass, have not yet been exploited to the full in South Africa, but there are a number of initiatives to expand their use.[139] Energy sources such as wind and solar energy are inherently intermittent, and the energy produced on sunny or windy days currently cannot be stored cost-effectively to use when there is no wind or sun.[140]

South Africa has large uranium deposits associated with its gold-bearing ores. Nuclear power is the only non- GHG emitting energy source that can effectively replace fossil fuels and satisfy global demand; it is not only cleaner than energy from fossil fuels, but also more sustainable than other energy sources such as fossil fuel, wind, and the sun.[141] Dr Moore further argues that in his opinion hydro-electric plants and nuclear plants are the best options for base load to sustain a country's economy. The amount of carbon dioxide produced in the full life cycle of nuclear energy production represents only 2% of the total amount produced by fossil fuel power plants as a result of the manufacturing and transportation (that is if carbon-based energy is used) involved in erecting the plant.[142] One nuclear power plant produces as much energy as between 500 and 1 000 wind turbines. Wind turbines contain much more materials per unit electricity produced than other plants; this increases the so-called carbon footprint of wind energy significantly.[143]

Advantages of Nuclear Energy[144]

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138 IAEA assessment report, 2013
139 IAEA's nuclear energy readiness assessment report,2013
140 IAEA nuclear energy assessment 2013
141 Moore P: Nuclear power is best energy source
142 Moore P: Nuclear power is best energy source
143 Moore P: Nuclear power is best energy source
144 Moore P: Nuclear power is best energy source

- Generating energy using nuclear is less expensive, as there is less uranium needed to produce the same amount of energy as coal or oil.
- Uranium is also less expensive to procure and transport, which further lowers the cost.
- Running a nuclear power plant is reliable; it can run uninterrupted for up to 540 days, resulting in fewer power interruptions.
- The running of the plant is also not contingent of weather or foreign suppliers, which makes it more stable than other forms of energy.
- Nuclear energy does have some emissions, the plant itself does not give off greenhouse gasses
- The generation of electricity through nuclear energy reduces the amount of energy generated from fossil fuels (coal and oil). Less use of fossil fuels means lowering greenhouse gas emissions (CO^2 and others).

Table 3. Estimated Energy Reserves[145]

Energy Reserves	**Estimated energy reserves in (*) (Solid and Liquid in million tons, Uranium in metric tons, Gas in billion cubic metres, Hydro in TWhr per year)**				
	Solid (1)	**Liquid (2)**	**Gas (3)**	**Uranium (4)**	**Hydro (5)**
Amount	30,156	2	10	144,600	14,000

4.20 Nuclear energy as one of the energy options for South Africa

The above discussion leads one to the conclusion that nuclear energy will be the best energy option for SA. The country has uranium as one of its resources, and the generating of nuclear energy would have fewer environmental and social impacts than the use of coal. It would be in the best interest of the country to invest in generating energy using nuclear.

[145] IAEA's nuclear energy readiness assessment report,2013

South Africa has two nuclear reactors generating 5% of its electricity. Government commitment to the future of nuclear energy is strong, with firm plans for a further 9600 MWe in the next decade, but the financial constraints are severe.[146] South Africa's nuclear decision, contained in the 2010 *Integrated Resources Plan* (IRP), and approved by Cabinet in May 2011, was put on hold in March 2013, delaying and possibly jeopardising the implementation of the country's atomic expansion programme for the third time in 15 years.[147] However, major policy disputes within the government emerged after the fledgling National Planning Commission (NPC), located in The Presidency, called a nuclear option for the country into question, despite the International Atomic Energy Agency's (IAEA) supportive visit earlier in 2013.[148]

Nuclear energy and its industrialisation have been embedded in a number of other government policies to date, often without being questioned. While the 20-year electricity development plan of the IRP envisages a nuclear fleet of six power reactors and associated full fuel-cycle infrastructure to add a 9,600 MW nuclear capacity to the national grid by 2013, nuclear industrialisation provisions were also contained in the country's *Industrial Policy Action Plan* (IPAP3), now in its fifth iteration.[149]

> South Africa is interested in the massive development of nuclear power, which is an important driver for the national economy growth, cooperation with Russia will allow SA to implement our ambitious plans for the creation by 2030 of 9, 6 GW of new nuclear capacities based on modern and safe technologies.[150]

In the 2011 *Draft Integrated Electricity Resource Plan for South Africa – 2010 to 2030* (IRP), nuclear prospects were revived for 9600 MWe supplying 23% of the electricity. In November 2013 NECSA signed a broad agreement with Russia's NIAEP-Atoms troy export and its subsidiary Nukem Technologies to develop a strategic partnership including nuclear power plants and waste management, with financial assistance from Russia.

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146 Barber *Africa's nuclear energy hopefuls learning from South Africa* 1-5.
147 Gilbert 2013 http://www.consultancyafrica.com.
148 Gilbert 2013 http://www.consultancyafrica.com.
149 Gilbert 2013 http://www.consultancyafrica.com.
150 Media release Pretoria 22 September 2014.

The strategic partnership implies joint implementation of the national nuclear power development programme of South Africa. The key project is construction of new NPPs with the Russian VVER reactors totalling 9.6 GW (up to 8 power units) in South Africa.[151]

Table 1: Energy options in South Africa[152]

Energy Options	Advantages	Disadvantages
Coal	The country has abundant coal reserves.	The most waste problems of all energy sources.
	Burning coal is the most cost-effective and energy efficient way of generating electricity.	South Africa's coal fields are concentrated in Mpumalanga, which limits the location options for power stations.
Wind	Wind power is renewable and freely available.	Wind doesn't always blow.
	It is clean and does not give off harmful gases.	Wind generators create noise and are expensive to build, which means the electricity will be expensive for consumers.
Solar Power Energy	The Sun is a renewable energy source with great potential.	
	The main benefit of using solar energy is access to inexpensive electric power in remote areas that are not connected to the national supply network.	
	Solar energy can be used in remote areas.	
	Sunlight can be converted directly into electricity using photo-voltaic (PV) technology, or indirectly with concentrating solar power (CSP).	

151 Barber *Africa's nuclear energy hopefuls learning from South Africa* 1-5.
152 Statistics South Africa, 2005.

Photovoltaic Solar Power Technology	It is renewable, clean and has no direct emissions.	Without battery storage, the energy is not available all the time.
	Solar panels can be used almost anywhere in South Africa.	The equipment is expensive.
	It is suitable for low energy use such as lights and television.	
Wave power	Waves are a free and sustainable energy source, created as wind blows over the ocean surface.	
	Energy is stored in these waves until it reaches the shallows and beaches of South Africa's coasts where it is released. Wave power technology involves two basic elements:	
	a collector to capture the wave energy and a turbo generator to transform the wave power into electricity.	
	Eskom is currently looking into the resource availability of wave power along the east and west coastlines of South Africa.	
Biomass power	The energy source is renewable.	The capital cost of building a biomass power plant is high.
	If waste is used, the cost of fuel can be close to zero and in some cases negative.	Fast-growing crops need substantial land area and the transport of fuel can be expensive, even if it is free.
		The proximity of the power plant to the fuel source is therefore an important consideration in terms of location.
Nuclear power	It is safe.	

	The Pebble Bed Modular Reactor (PBMR) technology is inherently safe and therefore more affordable.	Nuclear energy is often associated with nuclear weapons and there are concerns about nuclear waste safety.
	The process produces small volumes of waste to dispose of.	Nuclear stations with engineering safety systems are expensive, mainly because of the systems needed to ensure their safety.
Conventional hydropower	Water is a renewable source of energy.	
	The problem in South Africa though is that it is a dry country with few rivers suitable for hydroelectric plants.	
	The process of electricity gene-ration has no emissions.	
Micro hydropower	Power is continuous and available on demand.	Eskom has concluded that micro hydropower is not a feasible option for South African circumstances.
	The process is environmentally friendly.	It is argued that it is not economically viable at this stage.

If one looks at the renewable energy types discussed in the table above, all of them have more unwanted environmental impacts than nuclear energy, such as noise, an impact on biodiversity, and other environmental impacts and one need to acknowledge that there is a need to move towards the option that will be sustainable for the country, taking all factors into consideration (that is, environmental, social and economic factors) as well as the electricity capacity that can be generated from each energy type. Generating electricity using nuclear energy will reform the energy sector yet provide enough energy capacity to meet the social and economic needs of South Africa.

Generating energy using the nuclear option would reform the energy sector in South Africa. When one looks at the different items of legislation discussed above, the vision

common to all of them is the need to move towards renewable energy. Therefore generating electricity using nuclear technology will be the best option to reform the energy sector.

4.21 South Africa and nuclear energy developments

The government plans to extend Koeberg's (nuclear power plant) operating life from 30 to 40 years. Eskom solicited tenders for six new steam generators to be installed at Koeberg in 2017-18, aligned with planned maintenance. Then early in 2007 the Eskom board approved a plan to double generating capacity to 80 GWe by 2025, including construction of 20 GWe of new nuclear capacity so that the nuclear contribution to power would rise from 5% to more than 25% and coal's contribution would fall from 87% to below 70%.[153] The new programme would start with up to 4 GWe of PWR capacities to be built from about 2010, with the first unit commissioned in 2016.[154]

In the May 2011 budget speech, the energy minister reaffirmed that 22% of new generating capacity by 2030 would be nuclear and 14% coal-fired.[155] The budget also provided R586 million ($85 million) for the Nuclear Energy Corporation of South Africa (NECSA) "to continue with its central role as the anchor for nuclear energy research and development and innovation."[156] In December 2011 the energy minister said that some $50 billion would be spent on nuclear capacity to 2030. In November 2012 the cabinet endorsed a "phased decision-making approach for implementation of the nuclear programme", along with the "designation of Eskom as the owner-operator as per the Nuclear Energy Policy of 2008".[157]

In February 2012 the Department of Energy published a Revised Strategic Plan for six more nuclear power units by 2030 to help reduce the country's 80% reliance on coal-fired power plants.[158] It is evident that South Africa is actively participating in nuclear programmes and learning from other countries that have already explored this field,

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153 Barber *Africa's nuclear energy hopefuls learning from South Africa* 1-5.
154 Barber *Africa's nuclear energy hopefuls learning from South Africa* 1-5.
155 Barber *Africa's nuclear energy hopefuls learning from South Africa* 1-5.
156 Barber *Africa's nuclear energy hopefuls learning from South Africa* 1-5.
157 Barber *Africa's nuclear energy hopefuls learning from South Africa* 1-5.
158 Ramayia *Overview of renewable energy resources in South Africa* 1-5.

like Germany and France.[159] The nuclear reactors that government aims to install by 2030 will reform the energy sector and reduce gaseous emissions, thereby helping to fulfill section 24 of the Constitution.

On September 22, 2014 in Vienna, on the margins of the 58th session of the International Atomic Energy Agency General Conference, the Russian Federation and the Republic of South Africa signed an Intergovernmental Agreement on Strategic Partnership and Cooperation in Nuclear Energy and Industry.[160] The Agreement lays the foundation for the South African large-scale nuclear power plants (NPP) procurement and development programme, based on the construction in RSA of new nuclear power plants with Russian VVER reactors with a total of installed capacity of up to 9,6 GW (up to 8 NPP units). These will be the first NPPs based on the Russian technology to be built on the African continent.[161]

In September 2014 Rosatom signed an agreement with South Africa's energy minister to advance the prospect of building up to 9.6 GWe of nuclear capacity by 2030.In October 2014 a nuclear cooperation agreement with France was signed. The energy minister said: "This paves the way for establishing a nuclear procurement process".[162]

In November 2014 a similar inter-governmental cooperation agreement was signed with China. The energy ministry said that the agreement "initiates the preparatory phase for a possible utilization of Chinese nuclear technology in South Africa". Three further agreements in December were between NECSA and the China National Nuclear Corp (CNNC) to establish a cooperative partnership supporting the country's nuclear industry, between China's State Nuclear Power Technology Corp (SNPTC), the Industrial and Commercial Bank of China, and South Africa's Standard Bank Group, with a view to financing new nuclear plants, and between NECSA and SNPTC for training South African nuclear professional staff.[163]

South Africa has started seriously shopping around for companies to build eight new nuclear power plants totaling up to 9,600 MW by 2030 as part of their estimated $37

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159 International Energy Agency.
160 Media release Pretoria 22 September 2014.
161 Media release Pretoria 22 September 2014.
162 Barber *Africa's nuclear energy hopefuls learning from South Africa* 1-5.
163 Barber *Africa's nuclear energy hopefuls learning from South Africa* 1-5.

billion nuclear expansion programme.[164] South Africa's Minister of Energy Dipuo Peters declared the country's intention to add 9,600 MW of nuclear electricity - or six new nuclear reactors to the existing fleet. South Africa already has 1,844 MW of nuclear generated electricity - while countries such as Germany, Switzerland and Italy have completely rejected nuclear energy.[165] Eskom is conducting a mandatory Environmental Impact Assessment (EIA) for new reactors on three sites along the coastline.[166]

The newly-signed South African nuclear pacts set the framework for foreign suppliers to bid on the new nuclear build in a fair, competitive and cost effective manner.[167] The International Energy Agency states that:

> The introduction of nuclear power brings many challenges, not least of which is the very large upfront capital investment required, the need to develop technical and regulatory capacity, and to have the electricity demand and infrastructure capacity to absorb the resulting base load supply.[168]

The South Africa Department of Energy signed nuclear energy technology cooperation pacts with Russia on 20th September 2014and announced another with France on the 10th October 2014.[169] The Energy Department already has a nuclear pact with the US and will soon finalize pacts with China and Japan, using these to set the procurement guidelines for foreign suppliers to bid on the nuclear programme.[170]

South Africa has run two French-built AREVA reactors since1984 at the Koeberg Generation plant, East of Cape Town, which provided about 5% of the country's power. Koeberg is the only operating nuclear power plants in Africa.[171] The state-owned utility Eskom launched the development of a German-designed "pebble bed"

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164 Ramayia *Overview of renewable energy resources in South Africa*.
165 Teule R and Musana F (ed) *The true cost of nuclear power in South Africa, 5-20*.
166 Teule R and Musana F (ed) *The true cost of nuclear power in South Africa, 5-20*.
167 Ramayia *Overview of renewable energy resources in South Africa*
168 *Africa Energy Outlook Report* October 2013.
169 Ramayia *Overview of renewable energy resources in South Africa*.
170 Ramayia *Overview of renewable energy resources in South Africa*.
171 Ramayia *Overview of renewable energy resources in South Africa*.

modular reactor in 1998, but ran over budget and hopelessly behind schedule. The government pulled the plug in September 2010 after investing $1.3 billion.[172]

4.22 Energy options in South Africa

For the purpose of this study, it is important to first look at the energy options for South Africa. The table below draws a comparison between the energy options available to South Africa, and looks at both the advantages and disadvantages of each energy option in an attempt to ascertain which option will be suitable to cater South African energy needs in a sustainable manner while assuring the duties imposed by section 24(b) of the Constitution is fulfilled. The graph provides the energy generated from each energy option in MW.

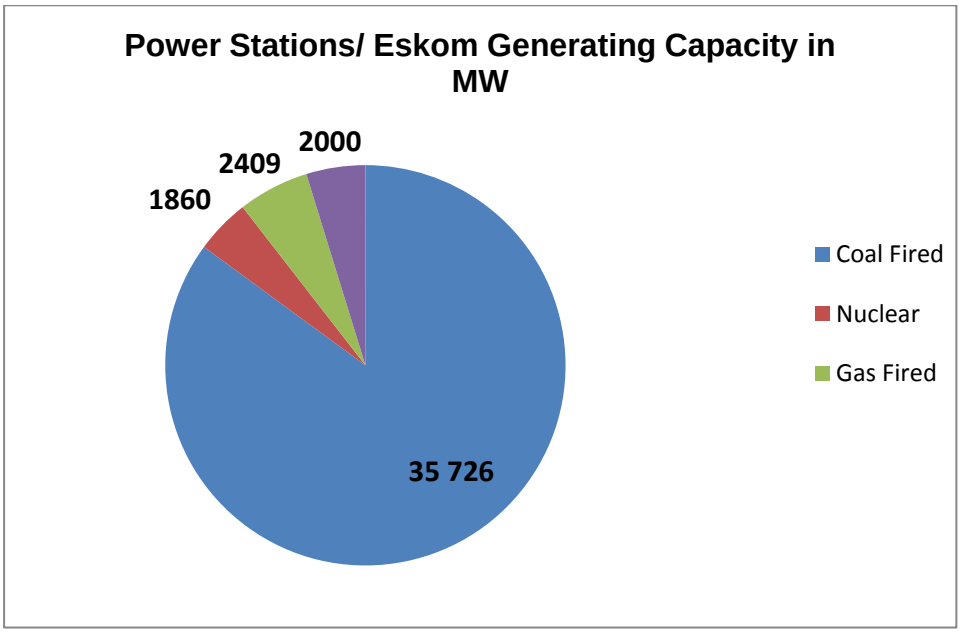

Figure 2: Electricity generated by Eskom in the financial year, 2014/15[173]

4.23 Conclusion

The South African Government remains committed to ensuring the security of the country's energy resources, and pursuing an energy mix that includes clean and

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172 Ramayia *Overview of renewable energy resources in South Africa*.
173 Eskom Integrated Report, 2014.

renewable resources to meet the needs of our fast growing economy, without compromising commitment to sustainable development.

There are a number of South African policies that address issues in the energy sector, regulating the energy sector and moving towards cleaner technologies. These policies have the objectives of reducing GHG emissions and moving towards renewable energy, cleaner technologies and trying to address climate change issues. NEM: AQA also provides standards with emission targets, which aim to regulate compliance with the legislation.

The vision and objectives of the South African policies recognise the importance of generating energy using renewable resources and moving towards cleaner technology. Although South Africa has good policies in place aiming to regulate the energy sector, the challenge the country is facing is compliance and enforcement. The legislation is based on the realisation that generating energy using renewables will be the best option to ensure compliance with the environmental right, but the challenge lies in finding out how to supply affordable electricity that will be accessible to all while mitigating the causes and effects of climate change.

One could argue that the challenge is the slow progress in terms of enforcement. Some scholars argue that this may be the result of a lack of capacity and resources on the level where enforcement is supposed to take place. Another factor in non-enforcement may be the challenge caused by the breakdown of communication between the spheres of government.[174] Kotze' further argues that the other challenge to enforcement is a lack of understanding of enforcement tools compliance and this has been the main reason for ineffective environmental protection through legislative or other means.[175]

In conclusion, one can conclude that South Africa has good environmental legislation and policies, but there is a need to optimise its environmental governance efforts so as to achieve the best possible results. Compliance and enforcement form part of the

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[174] Paterson A and Kotzé J (ed) *Environmental compliance and enforcement in SA*.
[175] Paterson A and Kotzé J (ed) *Environmental compliance and enforcement in SA*.

broader environmental governance effort, and can address the challenges in the energy sector.

The following chapter provides an outline of the environmental conventions to which South Africa is a party, and provide further detail on certain conventions which are currently relevant to emissions to air and are in the international spotlight, particularly the Framework Convention on Climate Change (FCCC). South Africa, for many years an international outcast, is a party to most international conventions and has an important role to play in international environmental law by virtue of its position as one of the stronger African countries.

5 International and regional or sub-regional legal and policy documents

5.1 Introduction

South Africa was an international outcast for many years, but is now a party to most international conventions and has an important role to play in international environmental law by virtue of its position as one of the stronger African countries. Africa's contribution to global greenhouse gas (GHG) emissions is only about 3%, but the continent is the one of the most vulnerable to the impacts of climate change, a global threat that is primarily due to the concentration of such gases in the atmosphere.[176] According to the UNFCCC, South Africa emits almost 400 Mt of CO_2annually, mainly from the electricity and Syn-fuel industries, where fossil fuel contributes 89.2 % to energy generation as a primary fuel resource.[177]

This chapter provides an outline of the environmental conventions to which South Africa is a party, and provides further detail on certain conventions which are currently relevant to emissions to air and in the international spotlight, particularly the Framework Convention on Climate Change (FCCC). The chapter also investigates the international and regional or sub-regional legal policy documents relevant to energy sector reform, in order to make recommendations on issues which SA can improve upon in terms of energy generation, if necessary. The chapter further looks at international instruments relating to atmospheric pollution in order to assess how well South Africa is fulfilling its International obligations. The following convention and treaties related to pollution and some principles will be discussed: the United Nations Framework Convention on Climate Change (UNFCCC), the Montreal Protocol, the principle of state sovereignty, the Rio Declaration Principles, the Stockholm Declaration (1972), the 1985 Vienna Convention for the Protection of the Ozone Layer and its Montreal Protocol, the United Nations Conference on Environment and

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176 Landi *Carbon capture and storage* 3-15.
177 Landi *Carbon capture and storage* 3-15.

Development (UNCED) - and some other conventions linked to environmental protection will also be discussed.[178]

South Africa is a party to a number of international conventions including atmospheric pollution conventions which will be discussed later in the chapter. South Africa has signed and ratified a number of conventions and treaties that address energy and environmental conservation for sustainable development. South Africa is also mindful of its international responsibilities to mitigate its GHG emissions. In order for South Africa to play its part in any global agreement on the reduction of GHG emissions, it will need to drastically reduce its reliance on fossil fuels for the supply of energy, thus decreasing its carbon intensity.

Certain international agreements impose specific requirements on South Africa. International obligations and agreements are covered in chapter 6 of NEMA and also chapter 6 of the NEM: AQA. South Africa has acknowledged its good neighbourly intentions by signing and adhering to international agreements.[179] The Air Pollution Information Network for Africa (APINA) has been established to address issues related to air pollution. APINA is a regional network of scientists, policy-makers and non-governmental organizations in Southern Africa. APINA aims to act as a link between different networks and programmes on air pollution in Africa. APINA has a Memorandum of Understanding with the Environment and Land Management Sector (ELMS) of the SADC to provide support on various issues concerning air pollution in the region.[180]

South Africa is mindful of its role in the African continent and its international obligations, and therefore that there is a need to reform its energy sector. This will require a change in energy generation so as to limit GHG emissions to the atmosphere. SA understands its constitutional duty as well as the principle that it must protect other states from the air pollution that it causes. For SA to be able to fulfil these obligations there will need to be a radical change in the manner of its energy

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178 The list of is not exhaustive to these conventions, protocols and principles; however the scope of this study is limited to the ones mentioned above.

179 South Africa country report fourteenth session of the United Nations Commission on Sustainable Development (UNCSD).

180 South Africa Country Report Fourteenth Session of UNCSD.

generation. The goals of the National Air Quality Management Programme (NAQMP) and the international conventions to which SA is a signatory will be discussed below.

5.2 Goal 7 of the National Air Quality Management Programme (NAQMP)

The Goal 7 relates to international cooperation. The goal is defined as follows:

- to develop mechanisms to deal effectively, and in the national interest, with international issues affecting air and atmospheric quality.

Although NEM: AQA provides various ways in which South Africa is able to implement its commitments and obligations in respect of various air quality related multi-lateral environmental agreements, much work is still required in using the Act effectively for this purpose. More work is needed in this regard to ensure that the national interest is addressed in the context of responding to our international commitments with respect to atmospheric quality. Generating energy using fossil fuels has a detrimental impact on the environment, while air pollution knows no boundaries. For South Africa to abide by its international co-operation and environmental commitments it needs to reform its energy sector.

5.3 International environmental principles and principles of customary international law

Some International environmental principles are soft laws which make it difficult for any state to avoid acting accountably and responsibly based on the notion of good neighborliness and the avoidance of the abuse of sovereign rights.[181] International law consists of rules, norms and principles that apply to nations in their dealings with one another. These rules were not imposed on the state parties; they were developed by the nations themselves. They have been defined generally as "the progressive gathering of recurrent treaty provisions, recommendations made by international organizations, resolutions adopted at the end of international conferences, and other texts that can be said to have influenced State practice".[182] These substantive rules

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[181] Lang 1999 *Max Planck UNYB* 157-172.
[182] McIntyre *The Role of Customary Rules and Principles* 1-5.

include the duty to prevent trans-boundary pollution, the duty to cooperate, the duty to conduct trans-boundary environmental impact assessments, the doctrine of sustainable development, the principle of intergenerational equity, the principle of common but differentiated responsibility, the precautionary principle, the polluter pays principle, and the ecosystems approach. The procedural rules include the duty to notify, duties relating to the ongoing exchange of information, duties to consult and to negotiate in good faith, the duty to warn, and duties relating to the settlement of disputes. This body of soft law is absolutely central to the discharge of the due diligence standards of the obligation to prevent harm.[183]

Air pollution knows no boundaries, meaning one cannot quantify how much air pollution is from each state country. This was well illustrated in Trial Smelter Arbitrations (US v Canada) in 1938 and 1941. The principle enunciated in that case was that activities in one country's territory should not harm the interests of another state. This was echoed in the principles of International Customary Law of the Stockholm Declaration.[184]

5.3.1 Principle of State Sovereignty

State sovereignty in terms of international law implies both "territorial sovereignty" and "territorial integrity". These two aspects are reflected in Rio principle 2 (Stockholm principle 21):[185]

> States have, in accordance with the Charter of the United Nations and the principles of international law the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.[186]

The principle of state sovereignty over natural resources is that states are "in principle" frees to decide how to manage their natural resources and their environment, and to decide whether and to what extent they will protect the

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183 McIntyre *The Role of Customary Rules and Principles*
184 Glazewski *Environmental Law in South Africa* 585-590.
185 Bugge 1997 *Environmental Law: From International to National Law* 53-72.
186 Principle 2 of the Rio *Declaration*.

environment. However, their sovereign right to exploit their natural resources is limited and conditioned by customary law, treaty law and other principles of international environmental law.[187]

5.3.2 Principle 21 of the Stockholm Declaration (1972) and Principle 2 of the Rio Declaration

Both principle 21 of the Stockholm Declaration (1972) and Principle 2 of the Rio Declaration that emerged out of the 1992 Earth Summit clearly affirm that countries have "the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or of areas beyond the limits of national jurisdiction." Under this principle, countries are prohibited from undertaking or allowing actions that will cause pollution in other nations.

5.4 1985 Vienna Convention for the Protection of the Ozone Layer

The 1985 Vienna Convention for the Protection of the Ozone Layer and, in 1987, its Montreal Protocol establishes a general obligation on the parties to protect the ozone layer for the sake of human health and the environment.[188] It is a framework convention which establishes no specific controls on ozone-depleting substances.[189] The aim is to reduce the consumption and production of ozone-depleting substances for example by setting up control measures among the parties and regulating the levels of consumption of ozone-depleting substances. Specific controls on ozone-depleting substances are established under the Montreal Protocol on Substances that deplete the Ozone Layer (1987).[190] South Africa is a signatory to this Protocol.

South Africa acceded to the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer on 15 January 1990. South Africa is currently developing an Ozone Layer Protection

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187 Bugge 1997 *Environmental Law: From International to National Law* 53-72.
188 Kaniaru *Managing Chemicals and Waste* 143-146.
189 Kaniaru *Managing Chemicals and Waste* 143-155.
190 Kaniaru *Managing Chemicals and Waste*143-155.

strategy that will indicate the response measures necessary to mitigate ozone layer depletion.[191] South Africa has a duty to protect the environment or Ozone Layer in cooperation with other States. As already said above, air pollution knows no boundaries.

5.4.1 Montreal Protocol

In 1987, 46 countries signed the Montreal Protocol on Substances that Deplete the Ozone Layer, and since then more than 160 countries have signed it. The Montreal Protocol is a protocol of the Vienna Convention on the Protection of the Ozone Layer (1985) that sets time-bound targets to reduce global emissions of ozone-depleting substances (ODS), taking into account developments in scientific knowledge, technical and economic considerations, and developmental needs.[192]

The objective of the Montreal Protocol is to protect the ozone layer by phasing out the production of numerous substances believed to be responsible for ozone depletion. The Protocol was drafted with the aim of reducing damage to the ozone layer, and it contributes significantly to the global warming control measures, as ozone depleting substances also have a greenhouse effect.[193] Protocol is meant to protect human health and the environment against some of the adverse effects resulting from human activities.[194]

The Montreal Protocol is arguably one of the success stories of global governance efforts in the field of chemical substances, with the parties having, it seems, managed to phase out 95% of the production and consumption of the listed substances as at 2005.[195] Global observations have verified that atmospheric levels of key ozone-depleting substances are decreasing.

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191 Pejan, Du Toit and Pollard *Using progressive realization*
192 Kakakhel *Global Governance: Chemicals* 80-83.
193 Younes *Chemicals: The Global Context* 121-123.
194 http://www.eoearth.org.
195 Kakakhel *Global Governance: Chemicals* 80-83.

5.5 United Nations Conference on Environment and Development (UNCED)

The United Nations Commission on Sustainable Development (CSD) was created to ensure effective follow-up of the United Nations Conference on Environment and Development (UNCED), and to monitor and report on the implementation of the Earth Summit agreements at the local, national, regional and international levels. The mandate of the commission was reaffirmed by the World Summit on Sustainable Development held in Johannesburg in 2002.[196] South Africa is expected to report to the Commission on the progress made in the implementation of Agenda 21 with regard to the review, evaluation and monitoring processes. The report specifically focuses on industrial development, climate change, air pollution, and energy for sustainable development. The key elements of the CSD-12 Report include a reflection on lessons learnt, best practice, the identification of actions, opportunities in and constraints to the implementation of sustainable development, and the formulation of the NSDS.[197] The United Nations Conference on Climate Change (UNFCCC), is one of the accomplishments of the 1992 Rio Earth Summit was the adoption of the UNFCCC to address problems associated with the global climate systems. The United Nations Conference on Environment and Development (UNCED), held in Rio in 1972, was negotiated; UNCED produced, The United Nations Conference on Climate Change (UNFCCC) is a "Framework" legal instrument for intergovernmental effort to tackle Climate Change.

The United Nations Conference on Climate Change (UNFCCC) is a "Framework" legal instrument for intergovernmental effort to address climate change. It acknowledges that:[198]

- The climate system is a shared resource.
- Human activities have been substantially increasing the atmospheric concentrations of greenhouse gas.
- These increases enhance the natural greenhouse effect: additional warming of the earth's surface and atmosphere;

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196 South Africa Country Report Fourteenth Session.
197 South Africa Country Report Fourteenth Session.
198 United Nations Conference on Climate Change (UNFCCC).

5.6 Objective

The objectives of the UNFCCC are to achieve the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, and to thereby prevent people-induced climate change by reducing the production of greenhouse gases. The Convention defines greenhouse gases as "those gaseous constituents of the atmosphere both natural and anthropogenic that absorb and re-emit infrared radiation". Such a level should be achieved within a time frame sufficient to:

- allow ecosystems to adapt naturally to climate change;
- ensure that food production is not threatened; and
- enable economic development to proceed in a sustainable manner.[199]

South Africa signed the Convention in 1993 and ratified it in 1997. As a developing country South Africa is not listed in the annexes, but it has obligations under the Convention. Parties are obliged to provide the Conference of the Parties with information regarding anthropogenic emissions and removals by sinks of those green-house gases not controlled by the Montreal Protocol. Developing and developed countries have different obligations and these are known as "national communications". South Africa's initial national communication was produced in 2004.[200]

The UNNFCCC pursues what has been called a "double track approach". Its primary objective is "to achieve the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (article 2).[201] This primary objective, usually referred to as "mitigation", is complemented by the secondary objective of "adaptation" to change, which is reflected in various provisions, such as article 3(2) and article 4(1)(e). The UNFCCC states that all parties "should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects"

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199 Article 2 of *United Nations Conference on Climate Change.*
200 Glazewski *Environmental Law in South Africa* 585-586.
201 Beyerlin and Marauhn *International Environmental Law* 159-165.

(article 3(2). Article 3(3) states that all parties "have a right to, and should, promote sustainable development".[202]

5.6.1 Fifteenth Conference of the Parties (COP 15/MOP 5)

The Copenhagen Conference (COP 15/MOP 5), attended by around 115 world leaders and more than 40000 registered participant, was one of the largest environmental meetings in history. It took place Copenhagen from 7 to 9 December 2009**.** The Copenhagen accord merely invites voluntary pledges for emission targets from developed countries and for nationally appropriate mitigation actions from developing than present generation, IT combating trans-boundary air pollution, ozone depletion and climate change are tremendous challenges that humankind faces here and now.

During COP 15 the President of South Africa (President Jacob Zuma) announced targets for CO_2 emission reduction by 34% by 2020 and 42% by 2025, subject to receiving technical, financial and capacity support from developing countries.[203]

5.6.2 1997 Kyoto Protocol to the UNFCCC

The Kyoto Protocol was adopted at the 3rd Conference of Parties in 1997. The United Nations Framework Convention on Climate Change (UNFCC) utilised the 1997 Kyoto Protocol (partially agreed to) as a tool to bind first-world countries to reducing their 1995 carbon emissions by 5% by 2012.[204] The Kyoto Protocol is an international instrument that provides for specific cooperative mechanisms that can be used to achieve the emission reductions required in the developed countries.

The Protocol provides that developed nations accept commitments to limit or reduce the emission of green-house gases according to different targets. South Africa ratified the United Nations Framework on Climate Change in August 1997 and acceded to the Kyoto Protocol in March 2002 as a non-Annex 1 signatory. Annex 1 countries are

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202 Beyerlin and Marauhn *International Environmental Law* 159-165.
203 *15th Conference of the parties: Copenhagen.*
204 http://www.economist.com/climatechange and developing countries.

committed to a 5% overall reduction in the period 2008–2012.[205] South Africa is a member of the UNFCCC, but as a developing country it is not bound by this resolution.

The Kyoto Protocol establishes the three so-called "flexible mechanisms" which annex 1 Countries may utilise in complying with their greenhouse gas emission reduction commitments, that is:

- Emissions trading, and
- The clean development mechanism (CDM)

5.6.3 Clean Development Mechanism (CDM)

The Clean Development Mechanism (CDM) allows developed and developing countries to work together to achieve the objectives of the Protocol. CDM can be used as a tool to assist non-Annex 1 Parties to achieve sustainable development and to contribute to the objectives of the convention.

5.7 South Africa and cleaner technologies

The key areas of interest for South Africa relating to CDM are to utilize the CDM to leverage foreign investment in the sectors that may be able to achieve emission reductions, to utilize CDM investment to promote various policy initiatives that could also contribute to emission reductions, and to use the CDM to leverage the transfer of technology that could underpin the achievement of policy objectives relating to increased competitiveness and value addition. Incentives have a role to play in various areas of CDM implementation.[206]

South Africa is committed to the efficient use of its coal through the employment of Clean Coal Technology like carbon capture and storage for the stabilisation of CO_2.[207]

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205 South Africa Country Report*: Atmospheric Pollution and Climate Change.*
206 South Africa Country Report Fourteenth Session of the UN.
207 *15th Conference of the parties: Copenhagen.*

80 % of GHG emissions come from the energy sector, from both supply and use, in the form of CO_2.[208]

South Africa is investigating Carbon Capture and Storage (CCS) as one of the potential tools to limit greenhouse gas emissions. A further driver for CCS in South Africa is the fact that South Africa, a non-Annex 1 UNFCCC "developing" country Party, is committed to demonstrating good international corporate citizenry by meeting international obligations and addressing climate change.[209]

5.8 Rio Declaration on Environment and Development

The concerns which have been raised in the earlier chapters about global climate change were articulated at the Johannesburg World Summit on Sustainable Development in 2002, and a corresponding commitment to promote renewable energy in all the participating nations was made in the Johannesburg Declaration.

The Rio Declaration on Environment and Development emphasises that there should always be a relationship between environmental protection and development, both of which are essential to life. Principle 1 of the Declaration states that human beings are at the centre of concern for sustainable development and are entitled to a healthy and productive life in harmony with nature.[210]

Sustainable development requires the consideration of all relevant factors, including the following:

> Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment pursuing the selection of the best practicable environmental option.[211]

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208 Department of Minerals and Energy, 2011.
209 Glazewski, Gilder and Swanepoel *Carbon Capture and Storage (CCS)* 8-10.
210 *3rd Economic and Social Rights Report:* Environmental Rights.
211 Environmental Rights – Period: April 2000-March 2002.

5.8.1 Rio Declaration Principle 15

The principle states that "development must be socially, environmentally and economically sustainable".[212]

The principle further states:

> In order to protect the environment, the precautionary approach shall be widely applied by states according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

5.8.2 Rio Declaration Principle 2

> States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

The limitation clause in this sovereignty principle not to harm the environment of other states or areas beyond the limits of national jurisdiction was first seen in the Trail Smelter Case discussed above.[213]

5.8.3 Rio Principle 4

> In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.

For development to be sustainable, policies and responsible approaches to the management of chemicals need to be in place, with these being aimed at ensuring the highest possible levels of safety and protection for people and for the environment.[214]

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212 *Rio Declaration on Environment and Development.*
213 Bugge 1997 *Environmental Law: From International to National Law* 53-72.
214 Younes *Chemicals: The Global Context* 119-122.

5.8.4 Precautionary Principle

The precautionary principle addresses circumstances where significant health, safety, or environmental risks may be involved but full scientific certainty is lacking. Principle 15 of the 1992 Rio Declaration reads:

> Where there are threats of serious or irreversible damage, lack of scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

Another formulation is that a country is not prohibited from taking measures to protect health or the environment

The root problems behind the principle, as illustrated by the problems of the ozone layer and climate change. Another important concept, known as the precautionary principle or *precautionary approach,* addresses circumstances where significant health, safety, or environmental risks may be involved although full scientific certainty is lacking. As SA is a Non-Annex 1 country it does not have emission targets to meet, but when one considers the way in which electricity is generated in SA one can only conclude that there is a need to apply the precautionary principle.

5.9 Conclusion

South Africa is mindful of its international obligations and the duty to protect other states' territory. In the context of the discussions above, it is clear that although South Africa continues to generate energy mainly from coal, it is committed to attaining substantial reductions in CO_2 emissions by 2025. The country supports research, technology development and special measures aimed at environmentally sustainable economic growth, which will assist in ensuring the reduction of greenhouse gas emissions into the environment, especially during energy generation. The point has been made in previous chapters that generating energy using coal leads to environmental and greenhouse gas emissions, and that energy reform is therefore needed to ensure that the country reduces CO_2 emissions, as pledged during COP 15, by 34% by 2020 and by 42% by 2025.

6 Conclusion and recommendations

Energy has been the key to economic development worldwide. As discussed in earlier chapters, the way energy is generated in South Africa offers both challenges and opportunities. Current South African energy activities relate primarily to the generation of electricity by means of the burning of fossil fuels and more specifically coal. Many environmental and social problems are caused by the way the energy system operates. The combustion, transportation and disposal of energy sources as they go through different conversion processes result in harmful emissions which in turn cause local, regional and global environmental problems, including serious, even fatal, human health hazards.

In South Africa one of the primary environmental issues is adverse emissions from fossil fuel-based electricity generation, resulting in a number of environmental and social impacts. This is due to GHG gases, NO_X's and SO_X's which have a negative impact on human health and the environment. Some of these gases that are released during energy generation contribute to global warming, leading to climate change and depletion of the ozone layer. The ever increasing demand for electrical energy has intensified the world's dependency on fossil fuels, resulting in the gradual escalation of greenhouse gas emissions into the atmosphere. Carbon emissions from the generation of electrical energy claim the principal position as the cause of global warming.

One needs to note that air pollution from energy generation travels a long distance, and air pollution knows no state boundaries. Therefore the impact of generating electricity from fossil fuels can have national, regional and international impacts. South Africa has a duty in terms of international cooperation to protect other states from the pollution emanating from its own activities.

South Africa's transformation is rooted in its Constitution, which provides a fundamental right to an environment that is not harmful to a person's health or well-being, and requires the environment to be protected for the benefit of the present and future generations. This protection should be afforded through reasonable legislative and other measures that secure ecologically sustainable development and the sustainable use of natural resources, while promoting justifiable economic and social

development. The Constitution is the supreme law of the country. From the environmental perspective, one of the biggest changes brought about the constitutional dispensation was the inclusion of the environmental right into the Bill of Rights, section 24.

The environmental right requires the States to refrain from activities harmful to the environment and to adopt and enforce policies promoting conservation and the improvement of the quality of the environment.

The previous chapters have sought to provide the necessary basis for critical discussions regarding the generation of electricity, and have sought to find out how the energy sector can be reformed. Reforming the energy sector is required in South Africa, taking into consideration the duty imposed on the state by section 24 of the Constitution, as well as international obligations from the conventions to which South Africa is a signatory. The discussion in this paper suggests that there is a need for energy sector reform in South Africa for the protection of the environment for present and future generation. This duty imposed on the state by section 24(b) can be achieved only by reforming the energy sector through legislation. The above chapters seek to determine what should be included in South African law and policies to ensure effective environmental compliance in the energy sector.

In line with its constitutional duty in terms of section 24(b), the legislature has enacted a range of statutes that attempt to protect the environmental resources and regulate harmful impacts on the environment. SA has a range of policies and legislation that seek to protect the environment. A reading of these suggests that the way electricity is produced does not comply with the constitutional right afforded to every citizen to a healthy environment. The policies demand that the country move towards renewable energy so as to ensure that energy generation is sustainable and protects people's health and the environment. Although a lot is said in the policies and legislation about reforming the energy sector, not much has been done in reality to bring this about. Critics argue that insufficient enforcement has been the main reason for ineffective environmental protection through legislative or other means.

Energy sector reform is needed to curb the detrimental impacts of coal-based electricity generation on the environment and human health in South Africa. The

energy sector should be regulated in terms of law and policy capable of facilitating the protection of section 24 rights. The government needs to ensure that the obligation or directive contained in section 24(b) of the Constitution is achieved by regulating energy sector reform in a constitutionally sound manner.

From the foregoing facts conclusion is made that the current coal-dominated electricity generation methods in South Africa are not contributing to the protection of the rights contained in section 24 of the Constitution. The State is required to respect, protect, promote and fulfil the right contained in section 24 of the Constitution. The main issue is about the lack of enforcement from government authorities, which can be due to a lack of resources or capacity in the relevant state departments, or a lack of understanding in other spheres of government where enforcement is supposed to take place. Air quality is managed mainly by provincial departments, and they do not cascade information down to municipalities.

6.1 Recommendations

The discussion above was an attempt to analyses what should be included in SA law and policies to ensure the realization of the right contained in section 24 of the Constitution. The following recommendations can be made to ensure the reform of the energy sector:

- Government departments are to enforce compliance in terms of section 24(b). Environmental Management Inspectors (EMI) should play an important role in promoting environmental compliance and enforcement. For the energy sector to reform there is a need to adhere to statutorily prescribed environmental standards and legislation to ensure compliance.
- Co-operative governance among the spheres of government needs to be fostered. Government departments need to work with one another. National departments must assist provincial and local authorities with air quality training.
- Departments are to capacitate other departments which are less resourced to ensure enforcement of the legislation.
- Air quality is a specialized field. Only a few individuals are trained in this field. It is difficult for some departmental officials to monitor compliance in other sphere

of government if the authorities themselves do not understand how to check the emission levels. Therefore there is a need to train more officials in the skills of monitoring emissions, so that they can ascertain if emission levels exceed the permitted levels.

- Diversifying the energy mix and investing in renewables would be the best option for South Africa, and the use of nuclear technology should be expanded to ensure that there less gas is released into the atmosphere. Generating electricity using the nuclear option does not lead to the emission of carbon dioxide and other greenhouse gases that can damage the environment, and also produces very little waste.
- Government authorities should invest in assisting companies on compliance issues, through training and awareness trainings so that compliance is everyone's responsibility. This awareness could assist the energy sector to incorporate compliance and enforcement into their daily operations, and could have both economic and environmental benefits, like promoting a good image of the company and avoiding the fines attached to non-compliances. This could also promote self-regulation in the industry.
- There is a need to use cleaner technologies, like CCS or retrofits, especially on old coal-fired power stations, which have high emission levels.
- Regulatory instruments must be used as the tool to monitor compliance, especially command and control tools Regulatory instruments need to be used in SA to regulate the energy sector.

6.2 Conclusion

It is evident from the above discussion that there is lot there has been done in terms of law and policies in South Africa in regulating the energy sector, in offering training and promoting awareness in both the industry and in other governmental authorities in terms of compliance and enforcement. Regulatory instruments will still to play an important role in regulating the energy sector until energy industry is reformed. The vision set out in relevant South African policy is to shift to renewable energy and to reform the energy sector; but there is a need to balancing the relevant economic and social issues in the context of energy generation.

BIBLIOGRAPHY

Literature

Adeola 2001 *Human Ecology Review*

Adeola FO "Environmental injustice and human rights abuse: the states, MNCs, and repression of minority groups in the world system" 2001 *Human Ecology Review* 39-60

Agren "Long range trans-boundary air pollution"

Agren C "Long range trans-boundary air pollution" 1997 *Encyclopedia of Life Support Systems* 1-10 also available at www.eolss.net/sample-chapters/c14/e1-44-02-08.pdf

Barber *Africa's nuclear energy hopefuls learning from South Africa*

Barber DA *Africa's nuclear energy hopefuls learning from South Africa* 21 October 2014

Beck *et al* 2011 *Energy Procedia*

Beck B, Surridge T, Liebenberg J and Gilder A "The current status of CCS development in South Africa" 2011 *Energy Procedia* 6157-6162

Beyerlin and Marauhn *International Environmental Law*

Beyerlin U and Marauhn T *International Environmental Law* (Hart Publishing Oxford 2011)

Blignaut *et al* "The external cost of coal-fired power generation: the case of Kusile"

Blignaut J *et al* "The external cost of coal-fired power generation: the case of Kusile" 2011. Journal of Energy in Southern Africa, Vol 23 No 4 (November 2012)

Breidenich *et al* 1998 *American Journal of International Law*

Breidenich C *et al* "The Kyoto protocol to the United Nations framework convention on climate change" 1998 *American Journal of International Law* 315-331

Bugge 1997 *Environmental Law: From International to National Law*

Bugge HC "General Principles of International Law and Environmental Protection – an overview" 1997 *Environmental Law: From International to National Law* 53-72

Chikosi "The true cost of coal in South Africa" 2010.

Cullet 1995 *Neth QHR*

Cullet P "Definition of an environmental right in a human rights context" 1995 *Neth QHR* 25-33

Davidson *et al Sustainable energy in Sub-Saharan Africa*

Davidson OR *et al Sustainable energy in Sub-Saharan Africa* (ICSU Regional Office for Africa Pretoria 2007)

Du Plessis *Fulfilment of South Africa's Constitutional Environmental Right*

Du Plessis A *Fulfilment of South Africa's Constitutional Environmental Right in the Local Government Sphere* (Wolf Legal Nijmegen 2008)

Eberhard "The future of South African coal"

Eberhard A "The future of South African coal: Market, investment, and policy challenges" (Working paper prepared for a program on energy and sustainable development January 2011)

Faure and Du Plessis *The balancing of interests in environmental law in South Africa*

Faure M and Du Plessis W *The balancing of interests in environmental law in South Africa* (Pretoria University Law Press (PULP) Pretoria 2011)

Gilbert 2013 http://www.consultancyafrica.com

Gilbert D 2013 *South Africa's future nuclear energy plans: Pivoting on foreign policy objectives and raising issues of concern for nuclear non-proliferation* CAI Analytical Research November 2013 http://www.consultancyafrica.com accessed

Glazewski *Environmental Law in South Africa*

Glazewski J *Environmental Law in South Africa* 2nd ed (LexisNexis Butterworth's Durban 2005)

Glazewski, Gilder and Swanepoel *Carbon Capture and Storage (CCS)*

Glazewski J, Gilder A and Swanepoel E *Carbon Capture and Storage (CCS): Towards a regulatory and legal regime in South Africa* (Institute of Marine and Environmental Law (IMEL) and African Climate and Development Initiative (ACDI) University of Cape Town Cape Town), 2012

IMBEWU Sustainability Report: *Framework for the Implementation of Carbon Capture and Storage (CCS) projects in South Africa*, IMBEWU Sustainability Legal Specialists (Pty) Ltd December 2010 ("World Bank Report")

IMBEWU Sustainability Report: *Framework for the Implementation of Carbon Capture and Storage (CCS) projects in South Africa*, IMBEWU Sustainability Legal Specialists (Pty) Ltd December 2010 ("World Bank Report")

Kaggwa, Mutanga and Simelane 2011 *AISA Policy Brief*

Kaggwa M, Mutanga S and Simelane T "Factors Determining the Affordability of Renewable Energy: a note for South Africa" 2011 *AISA Policy Brief* 1-10

Kakakhel Q *Global Governance: Chemicals - International Environmental Law-making and Diplomacy Review 2007*

Kolari T and Couzens E (eds) *International Environmental Law-making and Diplomacy Review 2007* (University of Joensuu – UNEP Course Series 7 University of Joensuu Finland 2008)

Kaniaru D *Managing Chemicals and Waste*: *Challenges for Developing Countries-International Environmental Law-making and Diplomacy Review 2007*

Kolari T and Couzens E (eds) *International Environmental Law-making and Diplomacy Review 2007* (University of Joensuu – UNEP Course Series 7 University of Joensuu Finland 2008)

Kidd *Environmental Law*

Kidd M *Environmental Law* 2nd ed (Juta Cape Town 2012)

Kolari and Couzens *International Environmental Law-making and Diplomacy Review*

Kolari T and Couzens E (eds) *International Environmental Law-making and Diplomacy Review 2007* (University of Joensuu – UNEP Course Series 7 University of Joensuu Finland 2008)

Paterson, Kotzé and Sachs *Environmental compliance and enforcement*

Paterson AR, Kotzé LJ and Sachs an *Environmental compliance and enforcement in South Africa: legal perspectives* (Juta Cape Town 2009)

Chikosi O "The true cost of coal in South Africa" Greenpeace Report 2010

Kolari T and Couzens E (editors) International Environmental Law-making and Diplomacy Review

UNEP- International Environmental Law-making and Diplomacy Review (University of Joensuu –Finland 2007)

Paterson A and Kotze J (ed) *Environmental compliance and enforcement*

Paterson A and Kotze J (ed) *Environmental compliance and enforcement in South Africa: Legal Perspectives* (Juta 2009)

Kotzé *South African environmental law*

Kotzé LJ *South African environmental law through the cases* (LexisNexis Durban 2008)

Kurukulasuriya and Robinson *Training manual on international environmental law*

Kurukulasuriya L and Robinson NA (eds) *Training manual on international environmental law* (United Nations Environment Programme Kenya 2006)

Landi *Carbon capture and storage*

Landi T CCS legal and regulatory activity in South Africa- Department of Energy

Lang 1999 *Max Planck UNYB*

Lang W "UN-principles and international environmental law" 1999 *Max Planck UNYB* 157-172

Levy *et al* 2014 *Environmental Health Perspectives*

Levy I *et al* "Evaluating multipollutant exposure and urban air quality: pollutant interrelationships, neighbourhood variability, and nitrogen dioxide as a proxy pollutant" 2014 *Environmental Health Perspectives* 65-72

Environmental Health Perspectives volume 122 number 1: *Evaluating Multipollutant Exposure and Urban Air Quality: Pollutant interrelationships, neighbourhood variability, and nitrogen dioxide as a proxy pollutant* 65

McDaid *The health impact of coal*

McDaid L *The health impact of coal - The responsibility that coal-fired power stations bear for ambient air quality associated health impacts* (Groundwork Report 20 May 2014)

McIntyre 2006 *National Resources Journal*

McIntyre O "The Role of Customary Rules and Principles of International Environmental Law in the Protection of Shared International Freshwater Resources" 2006 *National Resources Journal* 157-159

Meissen and Quéneudec 2006 www.geni.org

Meissen P and Quéneudec E 2006 *Overview of renewable energy potential of India* Global Energy Network Institute (GENI) www.geni.org accessed

Munnik "The social and environmental consequences of coal mining in South Africa"

Munnik V "The social and environmental consequences of coal mining in South Africa: a case study" (document prepared for a joint initiative of Environmental Monitoring Group, Cape Town, South Africa and Both ENDs, Amsterdam, The Netherlands January 2010) 1-24

Myllyvirta 2014 *Health impacts and social costs of Eskom's proposed non-compliance*

Myllyvirta L 2014 *Health Impacts and Social Costs of Eskom's proposed non-compliance with South Africa's air emission standards* (Greenpeace International)

Peiry K Basel Convention, January 2011

Ramayia J Overview of renewable energy resources in South Africa

Pejan R, Du Toit D and Pollard S *Using progressive realization and reasonableness to evaluate implementation lags in the South African water sector*

Riekert and Koch 2012 *Journal of Energy in Southern Africa*

Riekert JW and Koch SF "Projecting the external health costs of a coal-fired power plant: The case of Kusile" 2012 *Journal of Energy in Southern Africa* 52-66

Rummel-Bulska I *The Basel Convention on Hazardous Wastes*

Rummel-Bulska I *The Basel Convention on Hazardous Wastes - Problems, negotiations and solutions* - UNEP- International Environmental Law-making and Diplomacy Review (University of Joensuu –Finland 2007)

Scorgie *Urban air quality management and planning in South Africa*

Scorgie Y *Urban air quality management and planning in South Africa* (PhD dissertation University of Johannesburg 2012)

Srinivasan "The Basel Convention of 1989"

Srinivasan P "The Basel Convention of 1989: A developing country's perspective" 2003 (Liberty Institute India 24 September 2001)

Steele 2012 *Green Peace*

Steele M and Stendhal K "Water hungry coal: Burning South Africa's water to produce electricity" 2012 *Green Peace* 4

Teule R and Musana F (ed)

Teule R and Musana F (ed) *The true cost of nuclear power in South Africa*, Green Peace SA, 2011

Van Gelder and Spaargaren *Financing of Kusile and Medupi power plants*

Van Gelder JW and Spaargaren P *Financing of Kusile and Medupi power plants, South Africa* (Research paper prepared for Bank Track and Pacific Environment October 2010)

Voigt 2008 *Nordic Journal of Law Justice*

Voigt C "The role of general principles in international law and their relationship to treaty law" 2008 *Nordic Journal of Law Justice* 12

Winkler 2007 *Energy for sustainable development*

Winkler H "Energy policies for sustainable development in South Africa" 2007 *Energy for sustainable development* 26-34

Younes M *The Global Context. International Environmental Law-making and Diplomacy Review* 2007 Plan of Implementation of the World Summit on Sustainable Development

Younes M *The Global Context. International Environmental Law-making and Diplomacy Review* 2007 Plan of Implementation of the World Summit on Sustainable Development

Wolfrum 1983 *Heidelberg Journal of International Law*

Wolfrum R "The principle of the common heritage of mankind" 1983 *Heidelberg Journal of International Law* 312-337

Ziemer 2001 *Harvard Human Rights Journal*

Ziemer LS "Application in the Tibet of the Principles on Human Rights and the Environment" 2001 *Harvard Human Rights Journal* 233-

Case law

Hichange Investments (Pty) Ltd v Cape Produce Company (Pty) Ltd t/a Pelts Products 2004 2 SA 393 (E)

Minister of Health and Welfare v Woodcarb (Pty) Ltd 1996 3 SA 155 (N)

Legislation

Constitution of the Republic of South Africa, 1996

White Paper, 1998

National Environmental Management Act (NEMA) 107 of 1998

White Paper, 2003

Energy Act, 2008

National Development Plan, 2030

National Environmental Management Act (NEMA)

White Paper on Renewable Energy of the Republic of South Africa

Draft Energy Efficiency Strategy of the Republic of South Africa

Integrated Resource Plan

National Environment Management: Air Quality Act 39 of 2004

Reports

3rd Economic and Social Rights Report: Environmental Rights

ABB "*Photovoltaic plants*" Technical Application Papers

Sace A "Technical Application Papers No 10–Photovoltaic plants" 2010 *A Division of ABB SpALV Breakers*

Acid news no 3 September 2003: *The Convention on Long-range Trans-boundary Air Pollution* Department of Minerals and Energy, Report 2009

Business Day, 8 May 2012

Department of Minerals and Energy, Report 2010

Department of Minerals and Energy, Report 2011

Department of Minerals and Energy, Report 2011 *Mining in South Africa - A Case Study stations bear for ambient air quality associated health impacts*

"Developing countries and global warming, a bad climate for development" Integrated Resource Plan for Electricity Draft Report, 2010, Revision 2, Republic of South Africa Department of Energy (8 October 2010)

Eskom Holdings Limited, Annual Report 2009

Eskom Integrated Report, 2011

Eskom Integrated Report, 2013

Eskom Integrated Report, 2014

Eskom shelves new nuclear project, World Nuclear News (5 December 2008)

Green Paper on an Environmental Policy for South Africa, October 1996

Greenpeace International *True Cost of Coal*: *How people and the planet are paying the price for the world's dirtiest fuel,* 2008.

Greenpeace: The true cost of nuclear power in South Africa, 2011

International Energy Agency (IEA) – Key Energy Statistics. OECD, Paris, (2008)

Law, Division of Environmental Policy and Law United Nations Environment Programme, Pace University School of Law (New York)

Media release Pretoria 22 September 2014

Precipitation softening, GE Power and Water, 11 October 2012

South Africa Country Report Fourteenth Session of the United Nations Commission on Sustainable Development, September 2005

South Africa Country Report*: Atmospheric Pollution and Climate Change* Fourteenth Session of the United Nations Commission on Sustainable Development, September 2005

Southern African Power Pool Statistics Report 2008

International and regional instruments

Agenda 21 (Rio de Janero), 1992

Energy Efficiency Strategy of the Republic of South Africa, 2005

Framework convention on climate change, 1972

Kyoto protocol, 1997

Montreal protocol on substances that deplete the ozone layer, 1987

National Development Plan, 2030

Rio declaration on environment and development, 1992

United Nations convention on climate change, 1992

Vienna convention for the protection of the ozone layer, 1985

White Paper on the Renewable Energy Policy of the Republic of South Africa, November 2003

White Paper, 1998

Internet sources

www.eskom.co.za/ourcompany/sustainabledevelopment/*ClimatechangeCOP17*/ Documents/Eskom's accessed

Electrification_programmeshttp://www.economist.com/climatechangeanddevelopingcountries

http://www.iea.org/textbase/nppdf/free/2010/key_stats_2010.pdf *International Energy Agency 2010* Key World Energy Statistics

http://www.businessday.co.za/Articles/Content.aspx id

http://www.power-technology.com/projects/medupi-power/

http://www.power-technology.com/projects/kusilepowerstation/

http://unfccc.int/resource/docs/natc/snc_south_africa.pdf DEA 2011

http://www.greenpeace.org/raw/content/international/press/reports/true-cost-coal

Eskom http://www.eskom.co.za/live/content.php

TO WHOM IT MAY CONCERN

2 December 2015

I hereby certify that I have edited the language of a masters' dissertation by Nokulunga Zulu entitled "Energy sector reform and the protection of the rights contained in section 24 of the *Constitution of the Republic of South Africa*, 1996."

I am Professor Alan Brimer, DLitt (UPE), Professor Emeritus of UKZN.

Yours faithfully,

Alan Brimer