

CLIMATE CHANGE: STRENGTHENING MITIGATION AND ADAPTATION IN SOUTH AFRICA*

ABSTRACT

Global climate change is possibly the greatest environmental challenge facing the world this century. Although often referred to as 'global warming', global climate change is more about serious disruptions of the entire world's weather and climate patterns. South Africa, a developing country in Africa faces greater challenges both in terms of the impacts of climate change and the capacity to respond to it. South Africa is the most industrialized and electrified country on the African continent. Eskom, the national power utility in South Africa sources energy mainly from coal to generate electricity and power the industry. This activity ranked South Africa as the highest emitter of carbon dioxide on the African continent and this is having negative impacts because of its contribution to global warming and climate change. It is against this backdrop that steps are now being taken to strengthen mitigation and adaptation in order to evolve long-term frameworks to promote the reduction of greenhouse gas emissions needed to address global climate change. The South African government has issued stringent policies on climate change and also put in place legal and institutional frameworks to ensure implementation and compliance. These policy interventions are now having remarkable positive impacts on greenhouse gas emissions reduction.

This paper presents the some facts that the South African government, realizing the overall vulnerability of South Africa to climate change impacts, now deemed it fit and necessary to strengthen adaptation and mitigation measures in the country. With regards to South Africa's vital industries, the mining and energy sectors are particularly vulnerable with respect to climate change and there is need to also strengthen mitigation measures in these areas. Government has to take responsibility for the inaction of industry by implementing policies developed on climate change through implementable plans and actions and more importantly a visible change in government policy to hold industry accountable. The most effective strategies are likely to be to reduce present vulnerability and to enhance a broad spectrum of capacity in responding to environmental, resource and economic perturbations.

The paper reviews state of the art methods and tools available in the literature in helping to strengthen mitigation and adaptation strategies and measures. The paper also reviews the existing frameworks regarding the issue of climate change adaptation and mitigation. The paper discusses various mitigation and adaptation measures by Eskom in particular and strategies embarked upon by the national and local governments in South Africa to reduce greenhouse gas emissions.

Key words: climate change strategies, strengthening mitigation, adaptation, South Africa

1. INTRODUCTION

In South Africa, Climate change is truly a cross cutting issue that is affecting the entire economy as well as many specific sectors including energy, transport, agriculture, forestry, water resource management and provision of water services, and health.¹ A national climate change response strategy that promotes and strengthens integration

* Dr. Kolawole O. Odeku, is a Research Fellow at Fort Hare Institute of Technology, University of Fort Hare, Alice 5700, South Africa, Prof. Edson L. Meyer, is the Director Fort Hare Institute of Technology, University of Fort Hare, Alice 5700, South Africa and Agboola A. Teru is a researcher at Fort Hare Institute of Technology, University of Fort Hare, Alice 5700, South Africa.

¹ DEAT, Department of Environmental Affairs and Tourism, a National Climate Change Response Strategy for South Africa, 2004 at 2 available at http://unfccc.int/files/meetings/seminar/application/pdf/sem_sup3_south_africa.pdf (last visited May. 10, 2009).

amongst the programmes of the various government departments involved to maximise the benefits to the country as a whole, while minimising negative impacts.²

Many of the factors that make climate change unique also make it complex. It is a multi-scalar environmental and social problem, which affects different sectors.³ Consequently, the policy focus of most of the governments of the world and other stakeholders have now shifted from ‘What is the likelihood of climate change?’ to ‘What are the most appropriate responses to climate change in case the predicted impacts manifest?’⁴ The growing concern is that various scientific research results have confirmed that the issue of climate change is now real as it has started affecting the atmosphere and in particular, the African continent.⁵ If the warming continues,⁶ there is growing consensus that the prospect of adverse climate change is not going to diminish in the near future unless dramatic mitigation and adaptation measures are adopted and implemented.⁷

South Africa, a developing country in Africa is vulnerable to climate change mainly due to its energy intensive industrial and economic activities making her the highest emitter of greenhouse gases (GHGs) in Africa.⁸ Electricity generation and transmission in South Africa is mostly derived from the national power utility, Eskom. The utility generates over 90% of electricity by using technology which is based largely on coal-fired power stations.⁹ Production and consumption of coal in South Africa have grown steadily over the past two and a half decades, at an average annual rate of 2.7 percent. In 2007, about 125 million tons of coal or 64 percent was burned by Eskom in its power stations, with Sasol consuming another 47 million tons, both industries and

² Ibid.

³ Henny Osbahr, Building resilience: Adaptation mechanisms and mainstreaming for the poor, Fighting climate change: Human solidarity in a divided world Human Development Report Office Occasional Paper, Human Development Report 2007/2008 available at http://hdr.undp.org/en/reports/global/hdr2007-2008/papers/Osbahr_Henny.pdf (last visited May, 10, 2009).

⁴ Houghton, J.J., Meiro Filho, L.G., Callander, B.A., Harris, N., Kattenberg, A., Maskell, K. (Eds.), 1996. Climate Change 1995: The Science of Climate Change (Contribution of Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change). Cambridge University Press, Cambridge.

⁵ Balgis Osman Elasha, Mahmoud Medany, Isabelle Niang-Diop, Tony Nyong, Ramadjita Tabo and Coleen Vogel. Impacts, vulnerability and adaptation to climate change in Africa Background paper on for the African Workshop on Adaptation Implementation of Decision 1/CP.10 of the UNFCCC Convention Accra, Ghana, 21 - 23 September, 6 (2006).

⁶ Scott Johnson, World NEWS, Sustainable Development Law & Policy, Volume II, Issue 2 winter 72 (2007).

⁷ Thomas Downing, Lasser Ringius, Mike Hulme and Domini Waughray, Mitigation and Adaptation Strategies for Global Change 1997, Kluwer Academic Publisher, p. 19; see also Houghton, J.J., Meiro Filho, L.G., Callander, B.A., Harris, N., Kattenberg, A., Maskell, K. (Eds.), 1996. Climate Change 1995: The Science of Climate Change (Contribution of Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change). Cambridge University Press, Cambridge.

⁸ Earthlife Africa Jhb, Climate Change, Development and Energy Problems in South Africa Africa: Another World is Possible available at http://llnw.creamermedia.co.za/articles/attachments/19745_oi_climate_change_south_africa.pdf (last visited May, 10, 2009).

⁹ Energy Information Administration, Analysis Briefs, South Africa, South Africa Energy Data, Statistics and Analysis - Oil, Gas, Electricity available at http://www.eia.doe.gov/emeu/cabs/South_Africa/pdf.pdf (last visited May, 10, 2009).

small consumers accounting for the remainder.¹⁰ From the foregoing scenarios, it is apparent that mitigation and adaptation strategy in South Africa are primarily an energy issue.

The Stern Report warns that the cost of inaction will far outweigh the cost of taking action.¹¹ Acknowledging the overall vulnerability of South Africa to climate change impacts, it is necessary to embark on stringent mitigation and adaptation measures in the country.¹² Government, the stakeholders, role players and the business community are now being proactive and taken drastic measures and actions to reduce the threat of large scale adverse effects of climate change by strengthening mitigation and adaptation strategies.¹³ Fortunately, positive steps have begun with Eskom with plans to reduce the coal components of its generating capacity to 70% within 20 years. In the same vein, both industry and government have embarked on, and put in place various measures and strategies to address the issues of climate change and global warming, in order to foster sustainable development.¹⁴

2. THE ARGUMENT FOR STRENGTHENING MITIGATION AND ADAPTATION IN SOUTH AFRICA

The argument for mitigation and adaptation are related to the extent of present vulnerability and the potential impact of climate change. South Africa is more dependent on climatic resources and has a lower mitigation and adaptive capacity at present. With regards to vital industries, the mining and energy sectors are particularly vulnerable to climate change mitigation measures.¹⁵

There is need to strengthen adaptation and mitigation because climate change will still occur if emission reductions are successful, albeit at a reduced rate and magnitude. This is because the credibility of coordinated global emission reductions is low.¹⁶ More importantly, successful adaptation will improve the South Africans' international negotiating position. It will also yield benefits against existing climate related hazards; South Africa will derive economic benefits from the international industry in

¹⁰ Energy Information Administration, Analysis Briefs, South Africa, South Africa Energy Data, Statistics and Analysis - Oil, Gas, Electricity,...available at http://www.eia.doe.gov/emeu/cabs/South_Africa/pdf.pdf (last visited May. 10, 2009).

¹¹ Osbourne, H. 'Stern Report: The key points', (2006) available at <http://www.guardian.co.uk/politics/2006/oct/30/economy.uk> (last visited May. 10, 2009).

¹² DEAT, supra note 1.

¹³ Earthlife Africa Jhb, supra note 8.

¹⁴ Jan Peter Schemmel, Environmental Fiscal Reform for Sustainable Development and Poverty Reduction Workshop Proceedings and Country Case Studies. The World Bank Proceedings of the International Workshop on Reforming Forest Fiscal Systems to Promote Poverty Reduction, and Sustainable Forest Management October 19–21, 2003 World Bank, Washington, D.C.
<http://www.oecd.org/dataoecd/15/42/36309072.pdf>

¹⁵ Earthlife Africa Jhb, supra note 8.

¹⁶ Suraje Dessai and Jeroen van der Sluijs, Uncertainty and Climate Change Adaptation -a Scoping Study, Copernicus Institute for Sustainable Development and Innovation 2007 available at http://www.nusap.net/downloads/reports/ucca_scoping_study.pdf (last visited May. 10, 2009).

environmental services e.g. water management.¹⁷ Last but not the least, a credible and successful mitigation and adaptation policy coupled with a justified image of a long term climate strategy will increase the attractiveness of South Africa for investors as a stable environment.¹⁸

More importantly, it is increasingly recognized that adaptation and mitigation to climate change have become unavoidable.¹⁹ Different activities have various blends of adaptive and mitigative capacity. However, there is synergy between adaptation and mitigation in managing the risks associated with the enhanced greenhouse effect. Firstly, they each manage different components of future climate-related risk. Mitigation reduces the number and magnitude of potential climate hazards, reducing the most severe changes first. Adaptation increases the ability to cope with climate hazards by reducing system sensitivity or by reducing the consequent level of harm. Secondly, they manage risks at different extremes of the potential range of future climate change.²⁰ These are the two foremost strategies that are used in restricting the impact of climate change.²¹

The advent of climate change brings new challenges. Some of the challenges are brought about by issues related to the rate and magnitude of change of climate, the potential for non-linear changes and the long time horizons.²² All these issues are plagued with substantial uncertainties, which make anticipatory adaptation and mitigation difficult but inevitable. The fact that we have partial knowledge of future climate is in itself a new challenge.²³ This challenge is currently being addressed by the government of South Africa by embarking on implementation of stringent policies, strategies and measures that would curtail activities that are promoting greenhouse gas emissions. Furthermore, South Africa aims to maximise the benefits of managing climate risks by integrating adaptation and mitigation measures at their various scales of operation.

It is against this backdrop that the South Africa's Environmental Affairs and Tourism Minister, Marthinus van Schalkwyk, described the overall approach to climate change mitigation and adaptation as "progressive, ambitious, and far-reaching"²⁴ as well as focused on protecting South Africa from the "onslaught" of global warming.²⁵ He added that the goal is for carbon dioxide emissions to "stop growing by 2020–2025 at the

¹⁷ Kimo Goree, CLIMATE-L NEWS, The International Institute for Sustainable Development (iisd) ISSUE 13. April 23 to May 16, 2003, Published by the International Institute for Sustainable Development (IISD) available at http://www.iisd.ca/climate-l/Climate-L_News_13.pdf (last visited May. 10, 2009).

¹⁸ Jayant Sathaye, Adil Najam, Sustainable Development and Mitigation available at <http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-chapter12.pdf> (last visited May. 10, 2009).

¹⁹ Roger N. Jones, Paul Dettmann, Geoff Park, Maureen Rogers & Terry White, The relationship between adaptation and mitigation in managing climate change risks: a regional response from North Central Victoria, Australia *Mitig Adapt Strat Glob Change* (2007) 12:685–712.

²⁰ Ibid.

²¹ Waltham Forest Climate Change Strategy, Equality Impact Assessment, London Borough of Waltham Forest-Climate Change Strategy, Equality Impact Assessment, April 2008, available at <http://www.walthamforest.gov.uk/wf-ccs-eia-jul08.pdf> (last visited May. 10, 2009).

²² Suraje Dessai et al, supra note 16.

²³ Ibid.

²⁴ Edson Meyer and Kola Odeku, Climate Change, Energy, And Sustainable Development: Developing The African Continent at the Crossroads, *Sustainable Development Law & Policy Journal*, Vol. IX, Issue 2, Winter 2009, p. 51.

²⁵ Shaun Benton, SA adopts 'bold' climate change policy, *SouthAfrica.info*, July 30, 2008, <http://www.southafrica.info/about/sustainable/climate-300708.htm> (last visited May. 10, 2009).

latest, stabilize for up to ten years, and then decline in absolute terms.”²⁶ Towards this end, the government has started implementing stringent policies and measures and also enforcing the laws relating to environment²⁷ and pollution.²⁸ This approach is now shifting the country’s development path to become more sustainable and should gradually reduce carbon dioxide emissions.²⁹

2.1 MITIGATION STRATEGY IN SOUTH AFRICA

Mitigation is used in the sense of reducing greenhouse emissions. South Africa has initiated a number of actions that will reduce the pace of carbon emissions. These include policies to restructure the energy sector, stimulate economic development, increase access to affordable energy services, manage energy-related environmental impacts, and secure energy supply through diversification, as articulated in the government’s 1998 “Energy White Paper.”³⁰

There is a wide consensus amongst climate experts and policy makers that mitigation of climate change (i.e. reduction of greenhouse emissions) is and should remain the prime focus of climate policy.³¹ Mitigation potential in South Africa will stimulate economic development, stimulate the development of new and renewable energy sources, diversify energy sources, remove trade barriers; facilitate energy sector investment; promote demand-side management; eliminate subsidies; renewable portfolio standard of 5% of electricity generation by 2010, and 20% by 2025, replace coal used to produce synthetic petroleum with natural gas, 4 million tons in 2010, 3 million tons in 2010, 5-10 million tons if entire capacity is switched from coal to natural gas and renewable energy.³²

The two key policies that focus explicitly on climate change mitigation are the National Climate Change Strategy (NCCS) (2004) and the more recent Long Term Mitigation Scenario (LTMS) (2007) released by the government in 2008.³³ The NCCS was designed to address priority issues in terms of climate change in South Africa. The NCCS, a rare climate change strategy amongst developing nations, helped place South Africa in a strong position in international climate change negotiations.³⁴

²⁶ Ibid.

²⁷ Tim De Wet, South Africa: Improved Environmental Law Enforcement – The Era of the Environmental Law Bounty-Hunter?, Mondaq, Oct. 20, 2005, available at <http://www.mondaq.com/article.asp?articleid=35600> (last visited May. 10, 2009).

²⁸ SouthAfrica.info, SA gets tough on air pollution, SouthAfrica.info, June 27, 2005, <http://www.southafrica.info/about/sustainable/air-pollution-2106005.htm> (last visited May. 10, 2009).

²⁹ Themba Gadebe, Climate Change Body Launched, SouthAfrica.info, Oct. 20, 2005, available at http://www.southafrica.info/ess_info/sa_glance/sustainable/update/climate2010.htm (last visited May. 10, 2009).

³⁰ Kirsten Halsnæs and Jan Verhagen, Development based climate change adaptation and mitigation—conceptual issues and lessons learned in studies in developing countries *Mitig Adapt Strat Glob Change* (2007) 12:665–684 available at <http://www.springerlink.com/content/h5781155471j9063/fulltext.pdf> (last visited May. 10, 2009).

³¹ Suraje Dessai et al, supra note 16 at 7.

³² Davidson, O, Development Objectives Implementation Measures Reductions from Projected Emissions Source: Estimates by Energy & Development Research Centre, University of Cape Town, 2002.

³³ DEAT, supra note 1.

³⁴ Earthlife Africa Jhb, supra note 8.

The LTMS process was defined in two stages. First, the scenario building phase centered on research relating to carbon emissions, the potential for reductions and the economic implications defined in terms of the impact on GDP growth, employment and equity. Second the 'high level group' (HLG) process was to involve a 'dialogue' of the Inter-ministerial committee on climate change and 'leaders' from business, labour and civil society. The main focus of LTMS is on how South Africa can reduce emissions of GHG.

The LTMS includes different scenarios of mitigation action for South Africa and a technical report that is underpinned by technical inputs and research on energy emissions, non-energy emissions, and a macro-economic analysis. The combination of the scenario document and the technical reports serve to inform long-term national policy and provides South Africa with a position in multilateral climate negotiations on a post-2012 climate regime.³⁵ The LTMS starts from a base year of 2003 and continues to a 2050 horizon, and proposes two scenarios in regards to GHG emissions and these are; Growth Without Constraints (GWC) and Required by Science (RBS). It has been projected that under (GWC), GHG emissions are to lead to an almost four-fold increase in GHG emissions from 446 million tons of CO₂ - equivalent in 2003 to 1640 Mt CO₂ - equivalent by 2050.³⁶ The RBS scenario shows South Africa's emissions peaking and then declining. The question is what would happen if South Africa reduced emissions by 30% to 40% from 2003 levels by 2050? Current scientific thinking is that industrialised countries need to institute 90% emissions cuts by 2050 from 2003 levels. The RBS scenario paints a very different picture of South Africa in 2050. The scenario assumes investment in new technologies, such as renewables, hydrogen based transport and changes in human behaviour patterns.

The LTMS presents four strategic priorities which when implemented together, would allow South Africa to achieve the RBS Scenario. These options are titled: start now, scale up, use the market and reach for the RBS Goal.³⁷

The national government has set up a roadmap for the national process going forward from 2009 to 2012 and these are; National Climate Change Response Policy Development Summit (March 2009) (Adopt LTMS findings), sectoral policy development work (February – June 2009), post-2012 negotiation positions (Up to July 2009), UNFCCC post-2012 negotiations concluded (Copenhagen, December 2009), National policy updated for implementation of international commitments (March 2010), Green Paper published for public comment (April 2010), Final National Climate Change Response Policy published (end 2010), Policy translated into legislative, regulatory and fiscal package (from now up to 2012).³⁸

2.2 ADAPTATION STRATEGY IN SOUTH AFRICA

It has been generally recognised that global initiatives to reduce CO₂ emissions will take many decades. As such the negative impacts of climate change will become a reality to which we must adapt in order for the planet earth to continue to be

³⁵ Ibid.

³⁶ Ibid.

³⁷ Ibid.

³⁸ Ibid.

sustainable.³⁹ Adaptation to climate change has now become inevitable and unavoidable.⁴⁰ The IPCC has defined adaptation as an adjustment in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts.⁴¹ Adaptation is therefore made up of actions throughout society, by individuals, groups and government.⁴² In essence, adaptation is a complex societal process of activities, actions, decisions and attitudes that reflect existing social norms and processes.⁴³ Adaptation is often reactive, induced by observed extreme weather events and their impacts.

In South Africa, there is massive promotion of adaptation measures that require the development and implementation of low greenhouse gas emitting technologies and waste strategies, localisation of production, creation of sustainable and adaptable livelihoods, benchmarks and targets for progress to a less carbon and energy intensive economy.⁴⁴

For instance, Eskom, the highest emitter of CO₂ in South Africa has identified short-term adaptation measures to include dry-cooling in their new power stations, which can reduce water consumption by approximately 90%.⁴⁵ Medium to long-term considerations include improving the resilience of their infrastructure and staff, by incorporating adaptation issues into long-term planning and risk mitigation strategies. As one of their future plans, Eskom will develop an adaptation strategy that will be done with input from local and international experts.

3. STRENGTHENING MITIGATION AND ADAPTATION: POLICIES, MEASURES, STRATEGIES AND IMPLEMENTATIONS

3.1 RENEWABLE ENERGY

South Africa is one of the leading industrial countries in terms of its climate change and related energy policies in the African continent. This statement applies to not only South Africa's reduction in greenhouse gas (GHG) emissions but also to its development of a high level of overall institutional, informational–cognitive, technological, and scientific capacities. Recently, the government has started the diffusion of South Africa's policy instruments e.g., the Renewable Energy feed-in tariffs (REFIT) and technologies (especially wind and solar power) speak also to the leading role South Africa is taking concerning climate change.⁴⁶

Renewable energy sources provide less than 2 percent of electric power generation, but Eskom is developing over 100 MW of wind and solar thermal power.

³⁹ Elizabeth Kolbert, A Reporter's Field Notes on The Coverage of Climate Change, *Environment360* available at <http://e360.yale.edu/content/feature.msp?id=2130> (last visited May. 10, 2009).

⁴⁰ Suraje Dessai et al supra note 16 at 7.

⁴¹ Ibid.

⁴² Ibid.

⁴³ Henny Osbahr, supra note 3.

⁴⁴ DEAT, supra note 1.

⁴⁵ Emily Tyler and Daniel Turner, Carbon Disclosure Project South Africa Report, JSE Top 40 on behalf of 315 investors with assets of \$41 trillion 2007.

⁴⁶ Earthlife Africa Jhb, supra note 8.

These would be the largest such investments ever in South Africa. The electrification program goes beyond grid electricity with an off-grid rural concessions program that is to provide 350,000 solar home systems in seven concession areas.⁴⁷ It is pertinent to point out that the total Eskom capacity is 43000MW hence 100 MW of Renewable Energy is very small in comparison.

In 2006, Environment Minister van Schalkwyk demonstrated the energy-efficiency conversion of his home, which consisted of the installation of “energy-efficient lighting, solar water heating, better insulation, and a range of other measures.”⁴⁸ Minister van Schalkwyk stressed that although government action draws attention to these issues, individuals in South Africa must also take steps to save energy in their homes.⁴⁹ The Minister also stated that replacing one normal light bulb with a compact fluorescent bulb could result in savings of 18.50 South African Rand per year, as well as a total of 430 kilograms of coal and 1,100 litres of water.⁵⁰

There are also five combined bagasse-and-coal-fired power stations run by private sugar companies, primarily using sugar cane residues with coal as a back-up.⁵¹ There has also been an aggressive approach towards promotion and production of environmentally friendly biodiesel and bioethanol fuels manufactured from crops such as canola, soya, sunflower, sugar beet, maize, sorghum, wheat, and sugarcane.⁵² This will create new jobs, protect the country from volatile oil prices, and decrease damage to the environment.⁵³

3.2 RENEWABLE ENERGY TARIFFS

South Africa new renewable energy tariffs are a breakthrough in the country's efforts for a more sustainable climate and energy agenda, proclaimed both business analysts and environmentalists. South Africa is the largest emitter on the continent, dependent on coal for 90% of its electricity needs. The country's power regulator recently set renewable energy tariffs to boost investments in the sector and to meet South Africa's target of 2% of its power output (10,000GWh) from renewables by 2013. The country will pay 1.25 rand (\$0.14) for a kilowatt hour produced from wind, 0.94 rand from hydro, 0.90 rand from landfill gas and 2.10 rand (\$0.23) for power from concentrated solar.⁵⁴ The tariffs surpassed the expectations of even the most optimistic

⁴⁷ William Chandler, Roberto Schaeffer, Zhou Dadi, P.R. Shukla., Fernando Tudela, Ogunlade Davidson, Sema Alpan-Atamer, Climate change mitigation in Developing Countries, at 91 available http://www.pewclimate.org/global-warming-in-depth/all_reports/climate_change_mitigation (last visited May. 10, 2009).

⁴⁸ SouthAfrica.info, Fighting Climate Change at Home, SouthAfrica.info. Feb. 14, 2006, available at <http://www.southafrica.info/services/consumer/kyoto-140206.htm> (last visited May. 10, 2009).

⁴⁹ Ibid.

⁵⁰ Ibid.

⁵¹ Ralph Chipman, Trends in Consumption and Production: Household Energy Consumption, prepared by Oleg Dzioubinski ST/ESA/1999/DP. 6 DESA Discussion Paper No. 6 April 1999 United Nations, at 1.

⁵² Lucky Khumalo, Biofuels to Power Eastern Cape, SouthAfrica.info, March 9, 2007, <http://www.southafrica.info/business/investing/opportunities/biofuels-080307.htm> (last visited May. 10, 2009).

⁵³ Shaun Benton, *supra* note 25.

⁵⁴ Eskom intelligence brief, corporate strategy and planning, 31 March 2009 available at http://www.eskom.co.za/annreport08/info_sheets/001.htm (last visited May. 10, 2009).

industry players and will drive the industry forward, especially wind. There have already been enough large scale renewable projects announced to substantially overshoot the annual 10,000 GWh goal. The tariffs will now make those projects feasible and economically viable. These tariffs create an economically viable environment for independent power producers (IPPs) making use of renewable energy technologies.⁵⁵ The market is expected to be driven by joint ventures between project developers with local knowledge and private equity investments, backed by international wind turbine manufacturers.⁵⁶

The main aim of the target is to progressively reduce carbon-based power generation, and make a start with the move towards sustainable energy sources. Renewable energy feed-in tariffs are common in many countries and are aimed at encouraging renewable energy generation and making it financially viable for renewable energy generators.⁵⁷

3.3 ENERGY EFFICIENCY

Introduction of adaptation and mitigation measures in South Africa is of crucial importance because all available indicators suggest that the country will be one of the hardest hit in the event of any significant change in climate. The precautionary principle and common sense of preservation would thus suggest that South Africa should be among the most prepared adaptation-wise. Additionally, some of the required mitigation and adaptation measures to climate change may actually yield some developmental benefits that are not related to reduction in vulnerability. Energy efficiency and expansion of renewables, for instance, is one of the required mitigation and adaptation measures in South Africa in order to reduce the dependence on coal to generate electricity and power the industry expected to be severely disrupted by climate change.

The developmental benefit of this will be improvement in the energy outlook of South Africa, especially by virtue of the fact that energy savings via greater efficiency could enhance supply opportunities to non served areas. In the same vein, switch to solar- and wind-powered renewable energy will alleviate the epileptic nature of power supply experienced by coal fired electricity supply which led to massive power outage in the country in recent years. It may also be a more suitable and cheaper alternative for rural dwellers where grid extension is too costly. All of these considerations serve to strengthen the argument that mitigation and adaptation is an attractive and cost-effective response to climate change for South Africa.⁵⁸ The government has started implementing policies on energy efficiency, which is assuredly the most effective and economically advantageous means of reducing carbon dioxide emissions and other pollutants from energy production. Efficiency measures have also drastically reduced the cost of electricity bills to industry and individuals. This is producing substantial economic benefits.⁵⁹

⁵⁵ Ibid.

⁵⁶ Ibid.

⁵⁷ Ibid.

⁵⁸ Jekwu Ikeme, *Climate Change Adaptational Deficiencies in Developing Countries: The Case of Sub-Saharan Africa, Mitigation and Adaptation Strategies for Global Change* Kluwer Academic Publishers, 2003, at. 33.

⁵⁹ Richard L. Ottinger, *Global Climate Change Kyoto Protocol Implementation: Legal Frameworks for Implementing Clean Energy Solutions* Pace Law Faculty Publications 24 (2000).

South Africa has several programs addressing energy efficiency in energy production and the main energy-consuming sectors. Programs in the electricity sector are largely oriented around load management at peak hours, introducing consumers to efficient equipment such as compact fluorescent lamps and power management practices.⁶⁰ Selected industries are involved with Eskom in trial programs to introduce efficient motors and other equipment. These programs are expected to reduce the electricity demand by around 1,000 MW within three years, largely in South Africa. A recent study showed that a 5 % increase in electricity efficiency in 2010 would lead to a net increase of some 39,000 jobs and income of about \$80 million. A national drive toward energy efficiency of this scale would reduce emissions of carbon dioxide by roughly 1.5 million tons of carbon in 2010.⁶¹

At the household level, a major initiative has disseminated compact fluorescent lamps to replace incandescent bulbs. The Global Environment Facility and Eskom targeted all households with the intention of installing around 18 million Compact Fluorescents Lightings (CFL) over 20 years. Eskom estimates a total energy savings of 4 terawatt-hours per year, with carbon dioxide savings of almost 1 million tons of carbon per year. The short term target for this nationwide demand programme is to save 3000 MW by 2012 and 8000 MW by 2025. In reality this equates to about two in South Africa of our large coal-fired power stations.⁶²

Other activities include installing insulation in inexpensive houses and no cost measures such as proper site orientation for taking advantage of passive solar energy. Efforts have encouraged use of more efficient refrigerators and switching from paraffin to natural gas for cooking. These initiatives aim to improve the standard of living, reduce electricity bills, and improve health. For example, harmful paraffin combustion products are a significant cause of death among South African children.⁶³

3.3.1 ENERGY EFFICIENT FUEL

As energy is central to any analysis of trends relating to sustainable development,⁶⁴ energy efficiency depends both on the type of fuel used and on the characteristics of particular appliances. In South Africa's rural areas, traditional fuels such as fuelwood, charcoal and agricultural waste, constitute a major portion of total household energy consumption. The efficiency of a traditional fuelwood cooking stove is as low as 10 to 12%, compared with a liquefied petroleum gas (LPG) stove efficiency of more than 40%. Potential energy savings from the use of available efficient technologies for cooking, heating, lighting, electrical appliances and building insulation can reach as high as 75%.⁶⁵ Unfortunately, diffusion of these technologies, especially in South Africa is slow. However there have been progressive attempts to ensure that they are made available. Hence, massive research into how to get them available at the cheapest costs is

⁶⁰ William Chandler et al, supra note 47.

⁶¹ Ibid.

⁶² Eskom, Responding to Climate Change and Limiting the Impact on the Environment, 2008 available at http://www.eskom.co.za/annreport08/info_sheets/001.htm (last visited May. 10, 2009).

⁶³ Ralph Chipman, supra note 51 at 1.

⁶⁴ Ibid.

⁶⁵ Ibid.

ongoing. It is expected that breakthrough in the provision of these appliances would alleviate poverty in the country's rural and remote settings.

South Africa has set in motion changes that will replace coal-based synthetic fuel with cleaner regional sources, especially natural gas and hydroelectric power to be obtained from neighboring members of the Southern African Development Community (SADC). Sasol (South Africa's main synthetic fuel producer) has invested in large natural gas fields in Namibia and Mozambique, and South Africa and Mozambique have signed an agreement to build a gas pipeline to supply South Africa. Sasol will build the pipeline and use the natural gas to replace the coal feedstock for making liquid fuels.⁶⁶

3.3.2 ENERGY EFFICIENT BUILDINGS

National conservation policies also played their role in reducing household energy consumption. The most measurable effects were a result of strengthened building codes and boiler standards in South Africa coupled with appliance efficiency standards. The sharp reductions in energy intensities were due initially to cutbacks in energy services. Continued and more permanent reductions were due to technical improvements to buildings, electric appliances, and other equipment.⁶⁷

The government plans to establish energy efficiency norms and standards for commercial buildings. Guidelines in place for energy efficiency in commercial buildings will, after a five-year trial period, become mandatory. The guidelines cover minimum energy performance of the building shell and major energy-using services, including insulation for walls, roofs, ceilings, and floors. The Department of Housing has also developed national standards for permanent residential structures, including low-cost housing.⁶⁸

3.3.3 COMPLIANCE WITH DEVELOPMENTAL PLANS

It is important to note that it is not all mitigation and adaptation measures that are costly and that failure to mitigate and adapt today may actually entail greater cost in the long run. For instance, policies that are targeted at changing behaviors and practices may actually entail little or no cost. A good example may be outlawing development at certain areas such as the particularly vulnerable coasts in order to avoid huge impacts or asset-protection costs in the future.⁶⁹

3.3.4 ENERGY EFFICIENCY IN TRANSPORTATION SECTORS

In the transportation sector, efforts are being made to correct the effect of urban planning under Apartheid, which forced low-income commuters to travel much longer than high-income commuters. The Department of Transport is addressing this legacy in part by trying to introduce clean energy systems for transportation, including conversion

⁶⁶ Ibid.

⁶⁷ Ibid.

⁶⁸ Ibid.

⁶⁹ Jekwu Ikeme, *supra* note 58 at 42.

of internal combustion engines to natural gas, gas-to-liquids technology, and fuel-cell technology.⁷⁰

3.3.5 ENVIRONMENTAL FISCAL MEASURES

The then Minister of Finance, Trevor Manuel in the budget speech of 2009 has declared the intention and position of the government towards commitment to curtail behaviours and activities that are encouraging GHG emissions culminating into climate change. It is being proposed that there must be a tax to be imposed on incandescent light bulbs to encourage people to use compact fluorescent light bulbs and save energy.⁷¹

The Minister stated categorically that energy efficiency should be encouraged in the activities which have tax implications in order to reduce harmful emissions. Consequently, an incentive for investments by companies in energy-efficient equipment will be introduced, in the form of a supplementary depreciation allowance. The levy on plastic shopping bags will be increased from 3 cents to 4 cents. An increase is proposed in the international air passenger departure tax, which was last raised in 2005/06. The existing excise duties on motor vehicles will be adjusted to take into account carbon emissions.⁷²

More importantly, the Minister emphasized that South African companies should be encouraged to take advantage of the clean development mechanism established in the Kyoto Protocol. A favorable tax treatment will therefore be introduced for the recognition of income derived from the sale of emission reductions, as certified through this mechanism.⁷³

3.3.6 THE ROLE OF INSURANCE COMPANIES

The role to be played by the insurance sector in alleviating the impacts of climate has been widely acknowledged. The insurance industry can design its products to encourage its clients, the policyholders, and the authorities to adopt precautionary measures and at the same time reduce its own loss potential and the capacity problems this generates. The insurance sector in South Africa is now responsive to the insurance challenges of climate change. They are now increasing their level of knowledge about climate change.⁷⁴

3.4 RESEARCH, DEVELOPMENT AND DEMONSTRATION

Research is the key platform for the development and deployment of new carbon-reducing technologies that will result in reductions in greenhouse emissions in the long term. Eskom has a proud record of cutting edge research and development. South Africa has taken keen interest in research by engaging all relevant research institutes and centers

⁷⁰ Ralph Chipman, *supra* note 51.

⁷¹ Minister of Finance Trevor A Manuel Budget Speech 2009 (South Africa) 11 February 2009 available at <http://www.info.gov.za/speeches/budget/speech2009.pdf> (last visited May. 10, 2009).

⁷² *Ibid.*

⁷³ *Ibid.*

⁷⁴ Jekwu Ikeme, *supra* note 58 at 42.

of excellence (CoE) to embark on technological innovations that would remove South Africa from its current carbon footprints. Technologies are the most promising path to a safe global climate.⁷⁵ It is against this background that various energy efficient technologies are being developed and quite a number of them are being demonstrated in all sectors nationwide. More importantly, there has been a tremendous increase in the number of know-how in the country. There is a dearth of qualified researchers with the requisite expertise to study, gather and analyse climate data to serve the information needs for climate change mitigation and adaptation research and strategy development.⁷⁶ South Africa has embarked on a program for Monitoring, Mapping and Analysis of Disaster Incidents known as MANDISA.⁷⁷ It is a core activity for the Disaster Mitigation for Sustainable Livelihoods Programme of the University of Cape Town.⁷⁸ MANDISA began as a pilot program from 1990 to 1999 in the Cape Town Metropolitan Area.⁷⁹ The program evaluates socioeconomic and environmental risk factors that can affect the impacts of disasters and allows for tracking of the conditions that may cause disasters.⁸⁰ This requires cooperation between several agencies, “consultation and feedback, active sourcing of emergency and disaster information, strategic consolidation of information across agencies and robust geo-referencing.”⁸¹ The project also includes an online database which provides information for disaster management workers, educational institutions, and researchers.⁸²

In strengthening mitigation and adaptation, seasonal climate forecasts have been distributed in recent years to help farmers mitigate losses or optimize yields.⁸³ This is the current situation in the US. South Africa has adopted this mode of technology and it is currently having positive impact on response options, acting as a dynamic influence on climate change.⁸⁴

3.4.1 CLEAN COAL TECHNOLOGY RESEARCH

Eskom has reported that it will continue its reliance on coal as its primary energy source for the foreseeable future, although it plans to reduce the coal component of its generating capacity to 70% within 20 years. Clean coal technologies that use coal for

⁷⁵ DeWitt John, Opportunities for Economic and Community Development in Energy and Climate Change *Economic Development Quarterly* 2008; 22; 107 available at <http://edq.sagepub.com/cgi/content/abstract/22/2/107> (last visited May. 10, 2009).

⁷⁶ Jekwu Ikeme, supra note 60 at 42.

⁷⁷ EM-DAT: Emergency Events Database, http://www.emdat.be/Activities/other_data_subnational.html (last visited May. 10, 2009).

⁷⁸ Disaster Mitigation for Sustainable Livelihoods Programme, <http://www.egs.uct.ac.za/dimp/> (last visited May. 10, 2009).

⁷⁹ UN, United Nations Development Program Bureau for Crisis Prevention and Recovery, Reducing Disaster Risk: A Challenge for Development at 43,

⁸⁰ Ibid.

⁸¹ Ibid.

⁸² Ibid.

⁸³ Stern, P.C. and Easterling, W.E.: 1998, *Making Climate Forecasts Matter*, Panel on the Human Dimensions of Seasonal-to-Interannual Climate Variability, National Research Council, Washington D.C., National Academy Press.

⁸⁴ O'Brien, K.L. and Vogel, C.H (eds.) *Coping with Climate Variability: User Responses to Seasonal Climate Forecasts in Southern Africa*, Brookfield, VT, Ashgate Publishing 2001.

power generation in more environmentally acceptable and economically viable ways will form part of this mix. A number of clean coal technologies exist now and are expected to be available over the next 20 years. Examples of these are supercritical pulverised fuel, coal beneficiation, subcritical and supercritical circulating fluidised-bed combustion (FBC), fluidised-bed gasification (FBG), integrated gasification combined cycle (IGCC), and underground coal gasification (UCG). All of these technologies have advantages and disadvantages that need to be understood. Clean coal technologies are thus part of the Eskom research programme that focuses on assessing the different technologies under local conditions.⁸⁵

3.4.2 GASEOUS EMISSIONS

According to Eskom Annual Report 2008,⁸⁶ South African standards for emissions of SO₂ and NO_x are being formulated and will be incorporated into DEAT's 2008 national framework for air quality management. Numerous removal technologies are available to reduce the quantities of these gases prior to their release, ranging from low NO_x boilers and clean coal technologies to flue gas desulphurisation (FGD) and flue gas denitrification. FGD and denitrification systems have not been installed at any of the current power stations.

As regards the monitoring of emissions, Eskom calculates and records on a monthly basis the annual amounts of oxides of nitrogen (NO_x), sulphur dioxide (SO₂) and carbon dioxide (CO₂) emitted from power stations, based on the coal characteristics and power station design parameters. All coal-fired power stations are installing a continuous emissions monitoring system on one unit per power station.⁸⁷ This system provides a source of data and information on the GHG produced. Efficient technology can therefore be designed and installed in order to reduce emission.

3.4.4 DIVERSIFICATION OF THE ENERGY MIX

According to Eskom, every electricity generation technology has both positive and negative aspects. There is no "silver bullet", hence the need of access to all available options to make significant cuts in greenhouse emissions in the longer term. Eskom has reiterated and confirmed that the amount of CO₂ emission through its activities will increase in the short to medium term; but with the firm commitment to assessing options to retard that rate of increase and, ultimately, begin to decrease it. Eskom's intent, therefore, is to reduce its relative CO₂ (Mt CO₂/MWh), footprint until 2025 and, thereafter, to continually reduce absolute emissions in support of national and global targets. This will be done by investing in lower carbon emitting technologies as these technologies become available and meet the feasibility requirements. Eskom capital plan provides a significant opportunity to change its energy mix and this can be achieved by increasing the, renewables and clean coal components. Plans include increasing the renewables component to at least 1 600MW by 2025. Clean coal technologies are

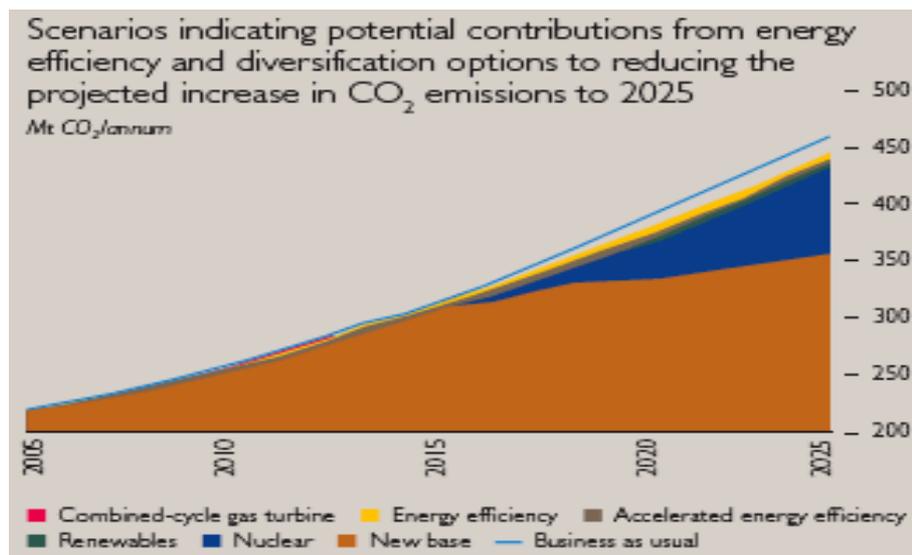
⁸⁵ Eskom, Responding to Climate Change and Limiting the Impact on the Environment, 2008 available at http://www.eskom.co.za/annreport08/info_sheets/001.htm (last visited May. 10, 2009).

⁸⁶ Ibid.

⁸⁷ Ibid.

already being applied to the coal-fired power stations under construction. In the longer term, its existing power stations will reach the end of their lives and be replaced with more advanced and less carbon-emitting technologies, further changing the energy mix and carbon intensity.

Eskom reported that it has modeled the potential contribution of demand- and supply-side initiatives to the future reduction of CO₂ emissions. A possible future scenario up to 2025 is illustrated in the figure below. With electricity supply growing at a potential 4,4% per annum and traditional coal-fired technologies remaining at a high percentage of the electricity generation mix (approximately 90%), CO₂ emissions from electricity generation would more than double over the next 20 years.⁸⁸ Through the implementation of several energy efficiency and diversification options, this increase can be limited. The potential contribution of the energy efficiency and diversification options, considered in this scenario, is indicated by the area graph below. These options show how Eskom would retard the rate of emissions growth from the “business as usual” line to the new emissions base line should the utility realise all the contributors.⁸⁹



Note that the technical and financial viability of these options is continually being re-assessed. (Source, Eskom Annual Report 2008).

The utility will continue to model scenarios based on technology choices to determine the most optimal way of reducing emissions. This work will not abate but continues to inform the diversification strategy.⁹⁰

⁸⁸ Ibid.

⁸⁹ Ibid.

⁹⁰ Ibid.

3.5 RURAL COMMUNITY INITIATIVES AND MEASURES

Adaptations undertaken at community level, making use of traditional knowledge to reduce the effects of climate-related disasters can be translated or improved in the face of climate variability and change. However, most of these examples are rural and include mechanisms for coping with droughts and floods. The agricultural sector has autonomously been adapting to climate variability, using different seed varieties and technologies, adjusting times of sowing and harvesting and moving spatially.⁹¹

4. CONCLUSION

A closer examination of efforts undertaken explicitly to address climate change such as establishing new focal points within government, establishing partnerships with other governments or the private sector, or launching pilot projects would also contribute to a fuller understanding of South Africa actions with the potential to affect future emissions.

Becoming a low carbon society is quite a challenge for South Africa as its economy is highly dependent on fossil fuels, particularly coal. The sustainable development policies and measures built on the national development objectives and priorities, is instrumental in moving South Africa toward a low carbon society. This is achieved by putting in place more stringent policies or by implementing new adaptation and mitigation measures that align the development path to follow a sustainable course.

The South African government is living up to its responsibility by taking a lead to develop and strengthen both mitigation and adaptation strategies by focusing on the ecological and economic aspects and more importantly on the social impacts of climate change. The government realized that failure to focus on the social impacts as well will result in increase in poverty, malaria, water shortages, food insecurity, drought, floods and migration, and harm those living with HIV and AIDS. The aftermath will be that the cost of government inaction will result in an even higher price later. There is a strong political will on the part of the South African government to fight climate change even though it is not under any obligation to reduce its GHG emissions. Realizing that economic growth, sustainable resource management, and climate change are closely connected, the executive and legislative arms of the government of South Africa have agreed on implementable and stringent policies measures and strategies on climate change. This will ensure that the country reduces emissions to become a “low carbon” economy while also helping to limit the effects of global warming. South Africa should serve as an example to the other nations of Africa as the developing continent becomes a stronger and more effective player in the fight against global climate change.⁹²

⁹¹ Julia Laukkonen, Paola Kim Blanco, Jennifer Lenhart, Marco Keiner, Branko Cavric, Cecilia Kinuthia-Njenga, Combining climate change adaptation and mitigation measures at the local level, *Habitat International* 33 (2009) 287–292

⁹² Edson Meyer et al, *supra* note 24 at 53.