

**A CRITICAL ANALYSIS OF THE ROLE OF LOCAL GOVERNMENT IN SOUTH
AFRICA'S LEGAL RESPONSE TO CLIMATE CHANGE**

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List of Abbreviations

AEL	Atmospheric Emission Licence
AQMP	Air Quality Management Plan
AQMS	Air Quality Management System
BPEO	Best Practical Environmental Option
CDM	Clean Development Mechanism
COP	Conference of the Parties
DWEA	Department of Water and Environmental Affairs
DME	Department of Minerals and Energy
EIA	Environmental Impact Assessment
IDP	Integrated Development Plan
IPCC	Intergovernmental Panel on Climate Change
LTMS	Long-Term Mitigation Scenarios
NEMA	National Environmental Management Act
NEMAQA	National Environment Management: Air Quality Act
NF	The National Framework for Air Quality Management in the Republic of South Africa
PAEL	Provisional Atmospheric Emission Licence
SAAQIS	South African Air Quality Information System
SAJELP	South African Journal of Environmental Law and Policy
SALGA	South African Local Government Association
SALJ	South African Law Journal
SAPL	South African Public Law
UNFCCC	United Nations Framework Convention on Climate Change

1 Introduction

The *United Nations Framework Convention on Climate Change*,¹ (hereafter the UNFCCC) defines climate change as the change of the earth's climate due to the harmful effects of human activities. During South Africa's recent Climate Change Summit² it was affirmed that climate change is one of the greatest threats to our planet and to its people.³

Section 24 of the *Constitution of the Republic of South Africa*⁴ (hereafter the *Constitution*) determines that everyone has the right to have the environment protected for the benefit of present and future generations. This section establishes an enforceable environmental right with both negative and positive duties.⁵ Consequently the State incurs a duty *inter alia* to protect peoples' environment from the negative impacts⁶ of climate change. This obligation also extends to the local sphere of government as affirmed by section 152(1)(d) of the *Constitution* which determines that one of the objects of local government is to promote a safe and healthy environment. During the Climate Change Summit it was stated that local government is "strategically positioned to be in the frontline in tackling climate change."⁷ The presumed important role that local government may play is returned to later in this study.⁸

The international community attempts to address the challenges inherent in climate change with the UNFCCC and its related instruments. The UNFCCC is an international instrument with the broad aim of preventing the negative effects of climate change. South Africa is a party to the UNFCCC, and when read with articles 26 and 27 of the *Vienna Convention on the Law of Treaties*,⁹ 1969 it has an international duty, in addition to its incidental duty in terms of the *Constitution*, to take

1 A 1 of the *United Nations Framework Convention on Climate Change* (1992).

2 Held at Midrand Johannesburg from 2-6 March 2009.

3 DEAT *Towards an Effective South African Climate Change Response Policy* 4. Available on the internet at <http://www.ccs Summit2009.co.za>.

4 *Constitution of the Republic of South Africa*, 1996.

5 Kidd *Environmental Law* 19.

6 A further discussion on the impacts of climate change follows in par 2 below.

7 DEAT *Towards an Effective South African Climate Change Response Policy* 4.

8 See para 3.6, 3.7, and 4.2 below.

9 *Vienna Convention on the Law of Treaties* (1969).

proactive measures in response to the environmentally relevant challenges that climate change will pose.¹⁰

The question at hand is what the role of local government is and should be in South Africa's legal response to climate change, generally. To determine the role of this sphere of government the legal framework governing local government and the environment will be critically considered. The *National Environmental Management Act*¹¹ (hereafter NEMA) establishes the core of South Africa's environmental framework legislation. Accordingly South Africa's response to climate change may principally be regulated by NEMA. The *National Environment Management: Air Quality Act*¹² (hereafter NEMAQA) as sectoral environmental legislation will also have an important role to play. Climate change is driven by poor air quality¹³ hence NEMAQA is of special relevance.

Sections 4 and 73 of the *Local Government: Municipal Systems Act*¹⁴ (hereafter the *Systems Act*) place obligations on local government regarding sustainable development, a safe and healthy environment and the progressive realisation of the environmental right contained in section 24 of the *Constitution*. In as far as both instruments establish framework law, it is expected that the NEMA read with the *Systems Act* would be the principal legislative framework for the implicit and/or explicit regulation of the role of local government in South Africa's response to climate change. Still, a focused statute such as the NEMAQA is expected to be the ideal kind of legal instrument for unpacking the peripheries and content of the role of local government in the said matter.

Based on the main research question above, this study reviews the phenomenon of climate change, South Africa's international and regional legal obligations in relation to this phenomenon, as well as the way in which local government- and environmental legislation provide for, or ought to provide for municipalities' meaningful involvement in the country's response to climate change.

10 These challenges are attended to in para 2.2 and 2.3 below.

11 *National Environmental Management Act* 107 of 1998.

12 *National Environment Management: Air Quality Act* 39 of 2004.

13 Greenhouse gases in the atmosphere drive climate change. See par 2 for a broad discussion of the causes of climate change.

14 *Local Government: Municipal Systems Act* 32 of 2000.

In order to achieve the aim of this study, a literature study of the relevant legislative framework, scientific reports, government publications and other relevant sources will follow. This study has been conducted with the focus on primary resources. Secondary sources have been consulted to clarify the legal position where it appeared necessary to do so. An initial review of the background to international climate change is conducted in paragraph 2. The nature of local government is considered in paragraph 3. Subsequently, South Africa's international and regional law duties pertaining to climate change are analysed in paragraphs 4 and 5, specifically with a view to assessing the role of local authorities. Finally, the study concludes with a critical analysis and recommendations towards the role that local government can play in South Africa's response to climate change, generally.

2 Background to climate change

A broad overview of climate change¹⁵ follows in order to understand the implications thereof for the local sphere of government. The causes, expected impacts and the possible responses to climate change are explained, to show and illuminate, albeit preliminary, the potential role of local authorities, which will be attended to in greater detail later in this study.¹⁶

2.1 Climate change as phenomenon

Climate change is caused by the alteration of the earth's natural energy cycle or balance due to human activities. This change is attributed to human activities that alter the composition of the global atmosphere in a direct or indirect manner.¹⁷ For the purposes of the UNFCCC climate change is defined as:¹⁸

15 The term "climate change" is preferred to the term "global warming" because the warming of the earth impacts not only on the average global temperature but on the climate system as a whole. Information on the science and effects of climate change is available from *inter alia* the Intergovernmental Panel on Climate Change's website at <http://www.ipcc.ch>. Specifically see the range of IPCC Fourth Assessment reports which is perceived to contain the most complete and scientifically correct analysis of climate change. Also see the UNFCCC's website at <http://unfccc.int/2860.php> for additional information

16 See par 3 hereunder.

17 Bulkeley and Betsill *Cities and Climate Change* 1.

18 A 1 of the UNFCCC.

a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

Accordingly, in this study the term "climate change" is understood to be the change in the earth's climate that is caused by human activities, as against the natural climate variability observed over previous periods of time.

Climate change is caused by an increase in the amount of greenhouse gases in the atmosphere.¹⁹ Greenhouse gases include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and halocarbons (a group of gases containing fluorine, chlorine and bromine).²⁰ These gases are released into the atmosphere as a result of a wide array of human activities. The increase of carbon dioxide is primarily caused by the burning of fossil fuels,²¹ while changes in land use and deforestation also play a significant role.²² Increases in the amount of methane and nitrous oxide in the atmosphere are caused by *inter alia* farming activities and changes in land use.²³

Greenhouse gases act like a blanket around the earth or, like the roof of a greenhouse; these gases trap heat on the earth's surface and in the atmosphere by preventing energy and heat from escaping from the planet. Accordingly the increase of these gases in the atmosphere alters the earth's energy balance, causing imbalances in the earth's climate system, meaning that the earth's temperatures will increase unnaturally.²⁴ It follows that increases of greenhouse gases cause climate change by reflecting heat back to the earth.

19 Hegerl "Understanding and Attributing to Climate Change" 665.

20 IPCC *Synthesis Report* 37.

21 Fossil fuels include oil, coal and natural gas. These fuels are widely used to generate electricity, and other forms of energy, and to propel vehicles.

22 Land-use changes refer among other things to the effects of deforestation, where trees that remove carbon dioxide (CO₂) from the atmosphere are cut down to make space for agriculture or living space for people.

23 IPCC *Synthesis Report* 37.

24 IPCC *Synthesis Report* 37.

2.2 Climate change impacts and responses²⁵

The term "climate change" alludes to the impacts of the phenomenon described above, meaning that the earth's climate system is changing due to the release of greenhouse gases and the warming caused thereby. Consequently climate change is affecting a wide range of natural and human environments.²⁶ As is shown below current findings indicate that several environmental changes are already taking place.

The earth's temperature is rising steadily, and this warming is disturbing several natural systems. Studies²⁷ show that global sea levels are rising due to the expansion of warming water and the melting of glaciers and the polar ice caps.²⁸ In addition to these changes the frequency of extreme weather events is also on the increase.²⁹ The amount of precipitation (rain, sleet and snow) is increasing in some parts of the world while simultaneously declining in other regions.³⁰ Heat-waves, heavy precipitation events (like thunderstorms) and extreme high sea levels³¹ have increased, worldwide. There is also proof of an increase in the number of climate-related natural disasters like tropical cyclones, floods, and tornados.³² Observations from across the world further show that many natural systems are being affected on the regional level. These impacts are varied and differ from region to region. Examples include planting crops earlier in spring, and changes in the distribution patterns of infectious diseases.³³

All of the above climate change impacts are already occurring globally. However, research shows that continued emissions of greenhouse gases at or above the

25 For a more detailed discussion on the effects and impacts of climate change see the IPPC report on Impacts, Adaptation and Vulnerability available at <http://www.ipcc.ch/ipccreports/assessments-reports.htm>.

26 Adger *et al* "Summary for Policymakers" 9.

27 See the IPPC Fourth Assessment reports, a range of scientifically correct and peer reviewed studies on climate change.

28 UNEP *Climate in Peril* 9.

29 UNEP *Climate in Peril* 10.

30 UNEP *Climate in Peril* 10.

31 In addition to the rise in average sea levels.

32 UNEP *Climate in Peril* 12.

33 UNEP *Climate in Peril* 13.

current rates will cause further warming and greater changes in the climate system.³⁴ When dealing with future climate change impacts, cognisance must be taken of the fact that the release of greenhouse gases has long-term implications. This means that if greenhouse gas concentrations are kept constant at today's levels, anthropogenic warming and sea-level rise may still continue for many centuries.³⁵ Accordingly it is essential that action is taken at various levels to manage climate change, as soon as possible.

2.2.1 Adaptation

Adaptation refers to the implementation of specific measures to adapt to the changes brought on by climate change, with the objective of reducing vulnerability to climate change and minimising the harm caused by it.³⁶ Successful adaptation is dependent on the implementation of adaptive measures on every level of government. Adaptive strategies³⁷ should be implemented by local communities, local governments, provincial governments, national governments and internationally. Accordingly it is necessary to include climate change considerations into the planning and budgeting of state institutions at all levels of decision-making.³⁸

From the outset it must be understood that the impacts of climate change are diverse and that it affects the different regions of the world differently and thus the need and nature of adaptive practices will vary accordingly. When developing adaptive measures one size will not fit all. Thus local or domestic knowledge and information will be essential in order to ensure effective responses to climate change in a particular country.³⁹ With this fact in mind some of the expected impacts of climate change are discussed below in conjunction with the proposed adaptation strategies that may be implemented in response to the impact.⁴⁰

34 UNEP *Climate in Peril* 13.

35 UNEP *Climate in Peril* 14.

36 IPCC *Synthesis Report* 56.

37 Further discussed below.

38 UNFCCC *Impacts, Vulnerabilities and Adaptation in Developing Countries* 29.

39 Reid and Vogel *Global Environmental Change* 201.

40 It should be noted that the UNFCCC has developed a variety of programmes to assist countries in the development of their adaptive strategies. These programmes can be viewed at <http://unfccc.int/adaptation/items/4159.php>. One of these programmes that is very relevant for this discussion is the Local Coping Strategies Database. The database contains information on

The IPPC identified a list of climate change impacts that will adversely affect Africa and grouped these impacts by sector.⁴¹ The water resources,⁴² health,⁴³ energy,⁴⁴ agriculture,⁴⁵ ecosystems,⁴⁶ coastal zones,⁴⁷ tourism,⁴⁸ settlements, industry and infrastructure sectors⁴⁹ have all been identified as sectors that will be affected by climate change. Consequently it will be necessary to implement adaptation strategies in each of these sectors to manage the said impacts. South Africa's vulnerabilities are briefly attended to below, in order to understand the adaptive measures that may have to be implemented in South Africa.

It is predicted that climate change has the potential to impose additional pressures on the availability, accessibility and demand for fresh water.⁵⁰ There will be an overall decrease of rainfall in South Africa, especially in the western parts of the country,⁵¹ while increases in temperatures and sea-level rise⁵² will cause a decrease in the availability of fresh drinkable water. Additional pressure will be placed on water resources due to increased evaporation and water run-off and due to high seasonal and inter-annual rainfall fluctuations.⁵³ The UNFCCC identified a series of key vulnerable sectors in developing countries including the water resources sector. It is suggested that urgent attention be given to these sectors due to their climate sensitivity.⁵⁴ Adaptation options include the protection of water resources and better management of these resources.⁵⁵

long-standing coping strategies and mechanisms that have been successfully implemented by communities that must have adapted to specific hazards or climatic conditions. This database could prove very useful to local authorities in the formulation a local response strategy.

41 Boko *et al* "Africa" 444-450.

42 Boko *et al* "Africa" 444.

43 Boko *et al* "Africa" 445.

44 Boko *et al* "Africa" 446.

45 Boko *et al* "Africa" 448.

46 Boko *et al* "Africa" 449.

47 Boko *et al* "Africa" 450.

48 Boko *et al* "Africa" 450.

49 Boko *et al* "Africa" 450.

50 DEAT *South Africa Environment Outlook* 5.

51 DEAT *South Africa Environment Outlook* 5.

52 DEAT *South Africa Environment Outlook* 5. The warming of the oceans due to climate change will cause sea levels to rise. This will in turn cause seawater to contaminate increasing amounts of freshwater in the coastal zones. The rising of the sea levels will cause an increase in coastal erosion, and a higher level of saltwater going up into estuaries, rivers and ground water. This will in turn cause less dilution of wastewater discharged into rivers and will cause an increase in coastal pollution.

53 Schulze and Perks *Climate change and water* 111.

54 UNFCCC *Impacts, Vulnerabilities and Adaptation in Developing Countries* 31. The other vulnerable sectors are agriculture and food security, human health, terrestrial ecosystems,

South Africa's agriculture and food production sectors will also be affected.⁵⁶ The production of basic foodstuffs such as maize will decrease,⁵⁷ while climate change will also impact on the fishing industries.⁵⁸ The decreases in food production can lead to severe food shortages. Examples of adaptive measures include the development of tolerant and resistant food crops and erosion control.⁵⁹

The increase in South Africa's general temperature and the decrease of rainfall in the western part of the country will have an impact on ecosystems. The habitats of animals and plants are expected to shift to the eastern parts of the country. This can lead to the extinction of species and a loss of biodiversity.⁶⁰ Adaptation options include the preservation of ecological corridors to protect eco-systems and biodiversity, and the establishment of protected areas.⁶¹

Impacts on the health sector may include an increase in the prevalence of malaria, as warmer weather allows mosquitoes to migrate to previous malaria-free areas.⁶² South Africa's health sector will in all probability have to carry an increased burden from malnutrition, respiratory and infectious diseases.⁶³ Adaptive measures include improved emergency responses and improved disease vector surveillance.⁶⁴

It should also be noted that settlements, industry and infrastructure will also be affected in various ways. In the coastal zones sea-level rise will impact on local infrastructure, while extreme weather events such as storms, floods and droughts will increasingly threaten settlements and infrastructure. In the latter instance

coastal zones and marine ecosystems. It must be understood that these are not the only sectors affected by climate change and where adaptation will be necessary, but the sectors referred to here are especially sensitive to climate change, and adaptation is therefore urgent in these areas.

55 For more examples of possible adaptation measures for these vulnerable sectors refer to table 1 included in the addendum hereunder.

56 Boko *et al* "Africa" 448.

57 IPPC *Synthesis Report* 37.

58 Boko *et al* "Africa" 448.

59 Depending on the circumstance, crops should be developed to be more resistant to drought, insects and pests, and increasing levels of salt in the soil.

60 DEAT *South Africa Environment Outlook* 5-6.

61 *Strategic Plan for the Environmental Sector* 9.

62 DEAT *South Africa Environment Outlook* 5-6.

63 *Climate Change 2007: Synthesis Report* 37.

64 Boko *et al* "Africa" 450.

important adaptive measures include improved disaster management and local development planning.⁶⁵

There are also linkages between climate change and air quality. Air quality is affected by weather and therefore it is very sensitive to weather changes driven by climate change. Studies show that air quality may be adversely affected by climate change, and that stronger emission controls will be needed to ensure that safe air quality standards are not exceeded.⁶⁶

From the above it seems that the current and expected impacts of climate change are diverse and that these impacts vary from region to region. Therefore successful adaptation will hinge on the understanding of the vulnerabilities of specific regions and it will be essential to conduct regular vulnerability assessments and to formulate adaptation plans at sectoral,⁶⁷ regional, and local levels.⁶⁸

2.2.2 Mitigation

To effectively respond to climate change the implementation of both adaptation and mitigation strategies is essential. Mitigation strategies are meant to reduce the amount of greenhouse gases in the earth's atmosphere, thereby eliminating the cause of climate change.⁶⁹ Adaptation and mitigation can be effective answers to climate change if used in conjunction with each other. Thus it will be necessary to adopt strategies and programmes to adapt to climate change, while steps are taken to mitigate the effects of climate change in the long run.⁷⁰ It is argued that the adoption of these measures will have to be driven by the development of appropriate national, provincial and local policies, strategies and legislation.

65 Boko *et al* "Africa" 450.

66 Jacob and Winner *Atmospheric Environment* 51. Weather is strongly dependant on climate, and as such, changes in climate will naturally affect weather patterns. Air quality, in turn, may be adversely affected by a range of factors, including weather conditions; hence provision will need to be made for the effect of weather changes due to climate change. See Jacob and Winner *Atmospheric Environment* for further reading on the subject.

67 For example the water, energy and transport sectors.

68 *The National Climate Change Response Policy* 21.

69 *UNFCCC Handbook* 74.

70 *DEAT South Africa Environment Outlook* 6.

2.2.3 Mitigation strategies

There are two basic approaches to climate change mitigation: the amount of greenhouse gas emitted by its sources⁷¹ can be reduced, and sinks and reservoirs⁷² that remove greenhouse gases can be preserved and enhanced.⁷³

The sectors responsible for the release of greenhouse gases are the energy, industrial, forestry, agricultural, transport, residential and commercial, and waste and wastewater sectors.⁷⁴ To reduce greenhouse gas emissions successfully requires the implementation of mitigating measures. As will be indicated in later in this study, South African local authorities have control over some of these sectors to varying degrees, and hence it will inevitably be necessary for these authorities to become involved in mitigation.

The reduction of greenhouse gas emissions at source can be achieved in various ways. The use of renewable energy sources,⁷⁵ for example, can achieve a great reduction of emissions in the energy sector; specifically in South Africa, as most of its greenhouse gas emissions here are caused by the generation of electricity.⁷⁶ In the transport sector mitigation can take place by moving from private road transport systems to public transport systems.⁷⁷ Options to reduce emissions in the building sector include the more efficient heating and cooling of buildings, and improved insulation.⁷⁸ In the industry sector emissions can be reduced by implementing standards controlling the release of greenhouse gases, among others.⁷⁹ It must be

71 A source as defined in A 1 of the UNFCCC means any process or activity which releases a greenhouse gas, an aerosol or a precursor of a greenhouse gas into the atmosphere.

72 A 1 of the UNFCCC defines a "reservoir" as a component or components of the climate system where a greenhouse gas or a precursor of a greenhouse gas is stored, while a "sink" means any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere.

73 UNFCCC Handbook 74.

74 UNEP *Climate in Peril* 18. The sector responsible for the highest amount of greenhouse gas emissions is the energy sector at 25.9% while the smallest contributor is the waste and wastewater sector at 2.8%. (Based on the world's emission statistics 2004).

75 Pacala and Socolow *Science* 2004 <http://www.sciencemag.org/> 30 Jul.

76 According the *Draft National Greenhouse Gas Inventory for the Republic of South Africa*, GN 1104 in GN 32490 of 12 August 2009 South Africa's energy sector is responsible for 79% of South Africa's greenhouse gas emissions.

77 IPCC *Synthesis Report* 60.

78 IPCC *Synthesis Report* 60.

79 IPCC *Synthesis Report* 60.

realised that there is a wide array of mitigation options available, and that the option most suitable for a specific situation will in each instance have to be identified.⁸⁰

2.3 Sustainable development and climate change

The principles of sustainable development and sustainability are extremely important in any response to climate change.⁸¹ Sustainable development can be defined as development which "meets the needs of current generations without compromising the ability of future generations to meet their own needs."⁸² On the other hand sustainability refers to the ability to maintain a desired condition.⁸³ Thus it is argued that sustainable development is a tool with which sustainability can be ensured.⁸⁴ The relevance of these principles becomes clear when the impacts of climate change as discussed above are considered.

Climate change will adversely affect the ability of countries to achieve sustainable development.⁸⁵ Shortages of water and food, and increases in extreme weather events that threaten livelihoods, for example, will impede the development of many countries.⁸⁶ But the reverse is also true as sustainable development can reduce countries' vulnerability to climate change.⁸⁷ This results from the fact that sustainable development pathways increase adaptive capacity and resilience to the

80 For more examples of mitigation strategies refer to table 2 in the addendum hereunder.

81 The principles of sustainable development is also incorporated into South African legislation, see par 5.1 below for a discussion of sustainable development as incorporated into NEMA.

82 Report of the World Commission on Environment and Development: *Our Common Future* (1987). For further reading on sustainable development see Kotzé *Integrated Environmental Governance* and Robinson *Ecological Economics*.

83 Kotzé *Integrated Environmental Governance* 254. A more complete definition of sustainability is given by Kotzé. He defines sustainability as: the ability to maintain a desired condition over time without eroding natural, social and financial resource bases, through a process of continual improvement in the form of sustainable development. Sustainability also relates to the integration of various considerations, including: the environment, the economy, social factors, environmental governance and management efforts, and public and industry involvement. Sustainable results may be achieved through the application and implementation of the various principles of sustainability and continual monitoring and post-decision follow-up of the results of these efforts.

84 Kotzé *Integrated Environmental Governance* 19.

85 UNFCCC *Impacts, Vulnerabilities and Adaptation in Developing Countries* 5.

86 UNFCCC *Impacts, Vulnerabilities and Adaptation in Developing Countries* 5.

87 Cosford *Public Health* 2.

adverse impacts of climate change.⁸⁸ In addition, research shows that the implementation of sustainable development principles can effectively mitigate climate change.⁸⁹ It seems therefore that the careful consideration of the principles of sustainable development is essential as it can play an important role in mitigating and adapting to climate change.⁹⁰

2.4 Conclusion

In the light of the above exposition of the meaning and scope of climate change as a worldwide phenomenon it appears as if climate change will, as was already alluded to, have several implications for South Africa. It is also clear that an effective response to climate change will be dependent on the implementation of effective mitigating and adaptive measures. It is predicted that local authorities will have to play an important role in such a response to climate change, but a final view on this will depend on the content and parameters of South African local government law as discussed in the subsequent paragraphs.

3 Local government

After an introduction to local government in general, this part of the study considers the nature, role, functions and powers of local government within the South African state. The objective of the discussion is to highlight the potential role that local government can play in the country's response to climate change. As will be indicated, the constitutional objectives and powers of local authorities assist in understanding the manner in which local government can utilise its authority to *inter alia* respond to climate change. The same holds true for distilling those functional areas of local government which will be affected by climate change, and where local

88 Adger *et al* "Summary for Policymakers" 20. The sustainable management of forests and natural habitats can reduce vulnerability to climate change by protecting biodiversity and water resources, for example. See Barker "Summary for Policymakers" 22.

89 Barker "Summary for Policymakers" 21. The use of sustainable energy sources, such as solar and hydroelectric power, instead of traditional energy sources such as fossil fuels, contributes to sustainable development, while reducing the emission of greenhouse gases, for example.

90 This theoretical assumption implicitly infiltrates the remainder of this discussion in this dissertation. For further information on sustainable development and sustainability see Strydom and King *Environmental Management* 10 and 38. Also see Kotzé *Integrated Environmental Governance* 16-21 and 254.

action may be essential. Integrated development planning also merits further discussion as it is perceived to be one of the tools in local government law that could be used to facilitate local government's response to and planning for the effects of climate change.

3.1 Introduction to local government

Government can be defined as the group of institutions or people governing a state, meaning that government dictates the general direction of public affairs.⁹¹ Local government functions within this larger concept. It is generally seen as the sphere of government that operates closest to the people.⁹²

Local government developed due to the principles of decentralisation and subsidiarity. In simplest terms the principle of subsidiarity requires that governance should take place as close as possible to the people, and that public functions that need not be handled by the central government should be delegated to provincial or local government.⁹³ This idea links with decentralisation, or the transfer of planning, decision-making, and administrative authority from central government to more specialised and autonomous government institutions.⁹⁴ The decentralisation of government functions has various advantages. These include improved efficiency in the performance of a function; more responsive government because smaller government units may be able to identify specific communities' needs more readily;⁹⁵ and improved administrative effectiveness, for example.⁹⁶

Local governments have evolved over time to provide a grass-roots level of government that strengthens democracy and development. Local authorities or municipalities have certain general characteristics that include locality, autonomy, governmental powers, participation, representation and legal personality. In general local governments are charged with a wide variety of functions that include but are

91 Du Plessis *South Africa's Constitutional Environmental Right* 100.

92 Bekink *Local Government Law* v.

93 CLC *Institutional Subsidiarity in the Constitution* 2. Also Du Plessis *South Africa's Constitutional Environmental Right* 100.

94 Hoyos and Uys *Journal of Public Administration* 27.

95 Hoyos and Uys *Journal of Public Administration* 27.

96 Du Plessis *South Africa's Constitutional Environmental Right* 100.

not limited to service provision.⁹⁷ Accordingly, local government can be described as the sphere of government that governs closest to the community, and that conducts a wide range of legislative and executive acts that materially affect the lives of people.⁹⁸

Given the characteristics and functions of local authorities in general it becomes clear that they may play an important role in environmental management and/or governance.⁹⁹ Local environmental governance is defined as:¹⁰⁰

The management process executed by local government and communities to holistically regulate human activities and the effects of these activities on their own and the total environment (including all environmental media, and biological, chemical, aesthetic, cultural and socio-economic processes and conditions) at local levels; by means of formal and informal institutions, processes and mechanisms embedded in and mandated by law, so as to promote the present and future interests human beings hold in the environment. This management process necessitates a collection of legislative, executive and administrative functions, instruments and ancillary processes that could be used by local government, the private sector and citizens to pursue sustainable behaviour within the community as far as products, services, processes, tools and livelihoods are concerned, both in a substantive and procedural sense.

The importance of local environmental governance can *inter alia* be derived from the *Rio Declaration on the Environment and Development*¹⁰¹ (hereafter the *Rio Declaration*). In the *Rio Declaration* the international community stated that "local authorities construct, operate and maintain economic, social and environmental infrastructure, oversee planning processes, establish local environmental policies and regulations, and assist in implementing national and sub-national environmental policies;"¹⁰² and as the level of governance closest to the people, local government will be a determining factor in the promotion of sustainable development.¹⁰³ The role

97 Du Plessis *South Africa's Constitutional Environmental Right* 100.

98 Venter (ed) *Government and Politics* 201.

99 Environmental management can be defined as: A management process executed by institutions and individuals in the public and private sector to holistically regulate human activities and the effects of human activities on the total environment (including all environmental media, and biological, chemical, aesthetic and socio-economic processes and conditions) at international, regional, national and local levels; by means of formal and informal institutions, processes and mechanisms embedded in and mandated by law, so as to promote the common present and future interests human-beings hold in the environment. See Kotzé in Paterson and Kotzé (eds) *Environmental Compliance and Enforcement* 107-108.

100 Du Plessis *SAPL* 58.

101 The *Rio Declaration on the Environment and Development* (1992).

102 Chapter 28.1 of the *Rio Declaration on the Environment and Development* (1992).

103 Chapter 28.1 of the *Rio Declaration on the Environment and Development* (1992). The *Rio Declaration* also called for the establishment of a Local Agenda 21 aimed at ensuring sustainable development on a local level. The role of local government in the implementation of sustainable

of local government in environmental governance is also accepted in South Africa, with both the *Constitution* and the *Systems Act* containing measures related to local governments' environmental mandate.¹⁰⁴

Due to the perceived role of local government in environmental governance, local authorities may also be suited to implement effective measures in response to climate change. This fact was acknowledged in the *Local Government Leaders' Declaration on Climate Change*¹⁰⁵ (hereafter the *Saitama Declaration*) wherein it was stated that local governments have "a special role and undeniable responsibility to take initiatives to protect the climate."¹⁰⁶ The reasoning behind this statement becomes clear when it is realised that the impacts of climate change are experienced in various ways and degrees depending on the locality.¹⁰⁷ Accordingly, programmes and policies developed on a national level could lack the specificity needed to address local circumstances. It is argued that higher levels of government should provide support, funding and guidance to enable the development of more specific strategies.¹⁰⁸ It follows that, provincial and local government will have to develop climate change preparedness strategies that have been designed to match their specific needs and unique circumstances.¹⁰⁹

This brief introduction showed that local authorities in general have several characteristics that enable them to play an important role in responding to climate change. The international community also accepts that local authorities have an important role in any climate change response. Subsequently, the structure of South Africa's local government will be discussed in order to assess to what extent the

development becomes even more relevant due to the importance of sustainable development in climate change mitigation as explained in par 2.4 above.

104 Discussed below in par 3.2.

105 The *Local Government Leaders' Declaration on Climate Change* (1995).

106 A 1.4 of the *Saitama Declaration*.

107 As explained in par 2 above.

108 Snover *et al Climate Guidebook* 27. Also see a 1.5 of the *Saitama Declaration* that requires national governments to be responsive to and support local activities in the following manner. National government should formulate and implement national plans that support local action plans. It should establish legal, institutional, and financial frameworks that enhance local government's capacity. Finally national government should provide necessary and appropriate resources to local governments to enable them to respond to climate change.

109 Snover *et al Climate Guidebook* 27. Also see Bulkeley and Betsill *Cities and Climate Change* especially chapter 1 with regards to the suitability of local authorities to initiate climate change programmes and strategies.

current legislative framework enables local government to respond to climate change in the South African context.

3.2 South African local government

The role of local government in South Africa has changed dramatically in recent years. In the past, local government was the lowest tier of government in a hierarchical government structure that derived its powers and functions from national and provincial government. As such, local government principally served as the administrative arm of higher government institutions and was mostly charged with the provision of services on the local level.¹¹⁰ This position changed with the introduction and acceptance of the *Constitution of the Republic of South Africa*¹¹¹ (the interim *Constitution* of 1993) and the final *Constitution* in 1996, wherein the system of parliamentary supremacy was replaced with the current system of constitutional supremacy.¹¹² The government structure changed from a hierarchical structure to a new structure, wherein local government is respected as a distinctive sphere of government.¹¹³

The *Constitution* brought the above change about by determining that the South African government comprises of national, provincial and local spheres. Each of these spheres is distinctive, interdependent and interrelated, and has its own constitutional powers, duties and responsibilities.¹¹⁴ The constitutional objectives of the local government sphere currently are:¹¹⁵

- (a) to provide democratic and accountable government for local communities;
- (b) to ensure the provision of services to communities in a sustainable manner;
- (c) to promote social and economic development;
- (d) to promote a safe and healthy environment; and
- (e) to encourage the involvement of communities and community organisations in the matters of local government.¹¹⁶

110 Steytler *Local government in South Africa* 184.

111 *Constitution of the Republic of South Africa* 200 of 1993.

112 Bekink *Local Government Law* 15.

113 Steytler *Local government in South Africa* 184.

114 S 40 of the *Constitution*.

115 S 152 of the *Constitution*.

116 It is expected that climate change will have implications for most, if not all, of these objectives. The objective to ensure sustainable service provision as contained in s 152(b) will be influenced by reductions in water supply, for example, in as far as it may influence a local authority's ability to provide sustainable water and sanitation services. The objective to promote social and

These objectives make it clear that local government has several functions in the South African state. These include sustainable service provision, democratic governance that encourages the participation of local communities, and the social and economic development of the area. In addition to the above objectives, local government also has an environmental mandate, as it has the constitutional duty to promote a safe and healthy environment.¹¹⁷ South African local government must hence provide governance that both encourage social and economic development and protect the environment. The important role that the environment should play in where and how local government regulate local communities is reinforced by an inclusive reading of sections 7(2), 24 and 27 of the *Constitution*.¹¹⁸

The constitutional objectives of local government also bring the developmental nature of local government to the fore. The *White Paper on Local Government*¹¹⁹ defines the nature of developmental local government. It states that developmental local government is local government committed to working with citizens and groups within the community to find sustainable ways to meet their social, economic and material needs and improve the quality of their lives.¹²⁰ The *Constitution* confirms and clarifies this developmental duty by determining that a local government must structure and manage its administration, budgeting and planning processes to give priority to the basic needs of the community.¹²¹ In addition thereto, the *Constitution* determines that local government must participate in national and provincial

economic development as contained in s 152(c) can be impaired by extreme weather events like drought and floods, for example. Climate change may also have a wide range of impacts on the environment as alluded to in par 2.2 above, thereby influencing local authorities' ability to ensure a safe and healthy environment.

117 The promotion of a safe and healthy environment entails the considerations of environmental, health and security issues in the governance of the municipal area. See Du Plessis *South Africa's Constitutional Environmental Right* 301. The inclusion of the requirement to promote a safe and healthy environment also acknowledges the duty of local government to give effect to the environmental right as contained in s 24 of the *Constitution*.

118 S 24 contains the right to an environment that is not harmful to health and well-being, and s 27 determines that everyone has the right to have access to health-care services, sufficient food and water, and social security. S 7(2) of the *Constitution*, determines that the state must respect, protect, promote and fulfil the rights contained in the Bill of Rights. Hence local government must promote these rights by implementing measures that protect the environment and secures access to food and water, health services, and social security.

119 GN 423 in GG 18739 of 13 March 1998.

120 For further reading on developmental local government see Steytler and De Visser *Local Government Law of South Africa* 28.

121 S 153(a) of the *Constitution*.

development programmes.¹²² Developmental local government's primary objectives appear to be to ensure the sustainable social economic development of a community to improve the quality of life of South Africans.¹²³ It is argued that in order to achieve this, particular attention must be paid to environmental affairs and the close relationship between social and economic development and a safe, healthy and protected natural environment. The intricate relationship between municipal service delivery and environmental management will also come to the fore as this study progresses.

Local government has constitutionally been positioned to play a key role in the development and transformation of South Africa.¹²⁴ When its developmental role is considered together with the scientifically foreseen implications of climate change, it seems inevitable that climate change will adversely impact on municipal development.¹²⁵ To estimate whether and how municipalities are able to respond to the impacts of climate change, the nature and structure of a municipality generally needs to be understood.

3.3 *The nature and structure of municipalities*

Local government is established in terms of and regulated by the *Constitution* and a series of statutes, the so-called suite of local government laws that was promulgated to regulate local governance further. These include: 1) the *Structures Act*, that provides for the establishment of municipalities and that regulates several matters related to the structures and organs within local government, and 2) the *Systems Act*, that contains a significant number of specific provisions necessary to ensure that a municipality is afforded the necessary statutory powers and capacity to meet its constitutional objectives. Most of the other laws related to local government emanate from or at least link with the provisions of the former two acts.

122 S 153(b) of the *Constitution*.

123 Asmah-Andoh *Journal of Public Administration* 104.

124 Steytler and De Visser *Local Government Law of South Africa* 28.

125 Studies show that climate change is expected to hamper the realisation of sustainable development, and of the Millennium Development Goals. See UNEP *Climate in Peril* 54.

Local government is comprehensively discussed in chapter 7 of the *Constitution*, but it is section 2 of the *Systems Act* which most clearly describes the nature of a municipality: it is an organ of state that exercises legislative and executive authority within its area of jurisdiction.¹²⁶ A municipality consists of the political structures, the administration of the municipality, and of the community itself. Local governments collectively serve as an autonomous sphere of government that may exercise executive and legislative authority without improper interference from other spheres of government.¹²⁷

The *Constitution* determines that there are three categories of municipalities which are further regulated in chapter 1 of the *Structures Act*. A Category A municipality is known as a metropolitan municipality and has exclusive executive and legislative authority in its area of jurisdiction.¹²⁸ This municipal category is characterised by large urban settlements with high population densities, a high degree of functional integration, and a complex and diversified economy.¹²⁹

Category C or district municipalities have executive and legislative authority in an area that includes more than one category B or local municipality. Thus all local municipalities must share their executive and legislative authority with a district municipality.¹³⁰ The division of powers between district and local municipalities is prescribed in the *Structures Act*. A district municipality must seek to "achieve the integrated, sustainable and equitable social and economic development of its area as a whole."¹³¹ It must perform integrated development planning for the whole district, promote bulk infrastructure development and services, build the capacity of local municipalities in its area, and perform their functions if they lack the capacity to do so. Finally district municipalities must ensure the equitable distribution of

¹²⁶ The municipalities' jurisdiction or boundaries are determined in terms of the *Local Government: Municipal Demarcation Act* 27 of 1998. The act provides *inter alia* the criteria and procedures for the determination of municipal boundaries, and thus jurisdiction.

¹²⁷ Steytler and De Visser *Local Government Law of South Africa* 26.

¹²⁸ S 2 of the *Structures Act* determines the characteristics of areas that must be governed by metropolitan municipalities. These are areas consisting of intensely developed conurbations with high population, intensive movement of people, goods and services; centres of economic activity with complex and diverse economies; single areas for which integrated development planning is necessary; and areas with strong interdependent social and economic linkages between their constituent units.

¹²⁹ The *White Paper on Local Government* 51

¹³⁰ S 155(1)(a), (b) and (c) of the *Constitution*.

¹³¹ S 83(3) of the *Structures Act*.

resources among the different municipalities in its area.¹³² In addition to the above, section 84 contains a specific list of functions and powers which fall within the mandate of district municipalities.¹³³ Powers and functions that are not specifically awarded to district municipalities fall within the mandate of local municipalities.¹³⁴

The distinctions between different categories of municipalities are important for various reasons. The NEMAQA, for example, allocates different functions to the different types of municipalities, thereby giving local authorities different duties in relation to climate change.¹³⁵ The distinctions between different municipalities also may imply that their ability to address climate change will differ. Climate change strategies may therefore have to distinguish between categories of municipalities.¹³⁶

Regardless of the type or category of municipality concerned, it is particularly important to establish how the powers and duties of municipalities may fortify or hamper local government's involvement in the implementation of a climate change response strategy or strategies.

3.4 Duties of local government decision makers

All municipalities must achieve the local government objectives that are contained in section 152 the *Constitution*. The specific local government organ responsible for the achievement of these objectives is the Council¹³⁷ of each municipality.¹³⁸ The Council has the right to govern the local government affairs of the community and exercise its executive and legislative authority, and should see to the financing of the affairs of the municipality by charging fees, rates, taxes, levies and duties.¹³⁹

132 S 83(3)(a) – (d) of the *Structures Act*.

133 S 84(1) of the *Structures Act*.

134 S 84(2) of the *Structures Act*.

135 See the discussion of NEMAQA in par 5.2 hereunder.

136 See SALGA *Local Government Climate Change Discussion Document* at 13 in which it is acknowledged that the differences in capacity must be considered when developing South Africa's climate change response policies.

137 These councils are established in terms of chapter 3 of the *Systems Act*, and serve as the executive and legislative body of municipalities.

138 S 4 of the *Systems Act*.

139 S 4 of the *Systems Act*.

Subject to a municipality's financial and administrative capacity as well as other practical considerations, the Council has all of the duties prescribed in the *Systems Act*. Councils must *inter alia* exercise their executive and legislative authority and use the resources of the municipality in the best interests of the local community.¹⁴⁰ They must provide democratic and accountable government that encourages the active involvement of the community in its affairs.¹⁴¹ The Council must also consult the community with regard to municipal services and the delivery of such services.¹⁴² It must ensure that it exercises its authority in a manner that allows the community to participate in all local governance processes.¹⁴³

A Council should strive to ensure that municipal services are provided in a financially and environmentally sustainable manner¹⁴⁴ and that all members of the community are provided with equitable access to such services. The Council is also responsible for development and for the promotion of development.¹⁴⁵ It should also promote a safe and healthy environment.¹⁴⁶ Finally the Council must respect and promote the progressive realisation of the fundamental rights contained in the Bill of Rights in the *Constitution* including the section 24 environmental right.¹⁴⁷ From the discussion of climate change earlier it can be perceived that climate change will have a wide range of impacts.¹⁴⁸ These impacts are expected to have consequences on the fulfilment of the Council's duties as described above.

Decision makers in local government have different rights and duties, some of which have a direct bearing on the environment of communities. For the purposes of this study, a more detailed discussion follows on the powers and functions of South Africa's local government with the aim of identifying the functional areas that will be affected by climate change. The identification of these functional areas is critical, as

140 S 4(2)(a) of the *Systems Act*.

141 S 4(2)(b) & (c) of the *Systems Act*.

142 S 4(2)(e) of the *Systems Act*.

143 The role of community participation in local governance is important for two reasons: The international legal framework (discussed in par 4) that governs climate change requires the active involvement of communities in the formulation and implementation of climate change response strategies. Secondly the local community takes part in, and influences, the governance of a municipal area directly and indirectly.

144 S 4(2)(d) of the *Systems Act*.

145 S 4(2)(g) of the *Systems Act*.

146 S 4(2)(j) of the *Systems Act*.

147 S 4(2)(j) of the *Systems Act*.

148 See par 2.2 above.

this will enable local governments to understand their potential role in South Africa's climate change response.

3.5 Functional areas of local government

As has already been indicated, section 156 of the *Constitution* determines that municipalities have executive and legislative authority with the right to administer all of the affairs listed in Schedules 4(B) and 5(B) of the *Constitution*.¹⁴⁹ Municipalities also have the right to take any actions that are necessary for, or incidental to the effective performance of their functions and powers.¹⁵⁰ A number of the functional areas for which local government in South Africa is responsible are expected to be particularly important for purposes of a discussion of local government's role in responding to climate change.¹⁵¹

Schedule 4(B) contains the following relevant areas that fall within the powers of local authorities: air pollution,¹⁵² building regulations,¹⁵³ electricity and gas reticulation,¹⁵⁴ fire fighting services,¹⁵⁵ local tourism,¹⁵⁶ municipal planning,¹⁵⁷ municipal health services,¹⁵⁸ municipal public transport, and municipal public

149 S 156(1)(a) of the *Constitution*.

150 S 156(5) of the *Constitution*. See Steytler and Fessha *SALJ* 327 as well as Du Plessis *South Africa's Constitutional Environmental Right* 303.

151 See climate change impacts, adaptation and mitigation as discussed in para 2.2, 2.3, and 2.4 above. Some of the implications of climate change for each sector will be referenced to and illustrated with an example in order to illustrate the relevance of climate change for that particular functional area. It is important to note that the manner in which climate change will affect these functional areas will vary from region to region. Accordingly the importance of local knowledge and research on the implications of climate change for a specific municipality should not be underestimated.

152 Relates to the management of greenhouse gases as well as the collection of information on greenhouse gas emissions, for example.

153 Important for mitigation and adaptation as these regulations can influence the energy efficiency of buildings as well as the resilience of buildings in the case of extreme weather events, for example.

154 Climate change can be mitigated by increasing energy efficiency and by the use of alternative energy sources, for example.

155 Expected increases in temperature and the higher prevalence of droughts will cause increases in the prevalence of fires.

156 The impacts of climate change on local tourism will vary, some areas are expected to experience less rainfall and higher temperatures, such impacts can adversely affect the popularity of tourism in an area.

157 Integrated short and long term municipal planning is essential for climate change mitigation and adaptation in the areas of transport and land use, for example.

158 Climate change can affect public health due to changes in disease distribution patterns.

works.¹⁵⁹ Other such areas of responsibility include pontoons, ferries, jetties, piers and harbours (excluding the regulation of international and national shipping and matters related thereto) storm-water management systems in built-up areas,¹⁶⁰ trading regulations,¹⁶¹ water and sanitation services limited to potable water supply systems, and domestic waste-water and sewage disposal systems.¹⁶²

The relevant functional areas as per Schedule 5 (B) include: municipal parks and recreation, public places,¹⁶³ refuse removal, refuse dumps and solid waste disposal,¹⁶⁴ and street lighting.¹⁶⁵

Several of the areas expected to be significantly affected by climate change that were identified in paragraph 2 above and for which adaptation and mitigation measures should be implemented, fall within the functional areas of local government. Hence, in addition to the constitutionally entrenched duties to protect the environment and to govern local affairs, municipalities may also be further affected by climate change obligations in terms of international law. Although the South African state is committed to international climate change law obligations a lot remains to be said for sub-state organs' role in actually implementing and realising such obligations. Accordingly it will be necessary to critically analyse the international legal framework in the light of the identified functional areas of local government competence, in order to comprehensively assess municipalities' role in responding to climate change.¹⁶⁶

159 Climate change can be mitigated through passenger modal shifts from private to public transport, for example.

160 Sea level rise, increases in precipitation due to changes in climate and the higher prevalence of extreme weather events like storms are expected to place additional stresses on storm-water management systems, for example.

161 Trading regulations can be used to encourage local communities to buy produce locally, thereby reducing the local economies carbon footprint to mitigate climate change.

162 These systems may be influenced by reduced water availability, for example.

163 Management of parks and public places to 'green' the urban environment is important. Urban greening is essential as it reduces the urban heat island effect and could mitigate climate change by reducing the amount of greenhouse gases in the atmosphere. For further reading on the urban heat island effect see Laukkonen *et al.* *Habitat International* 289 and ICLEI 2009 www.hotcities.org.

164 Climate change can be mitigated by the recovery of methane from landfill sites, for example.

165 Climate change can be mitigated by, amongst other, the use of energy efficient lighting strategies.

166 South Africa's international obligations are further attended to at par 4 hereunder.

It should at this point, however, be noted that the *Constitution* requires that all constitutional obligations must be preformed diligently and without delay. Thus, the performance of one function should not cause another function to be neglected.¹⁶⁷ This implies that the measures a local authority implements in response to climate change should not adversely impact on its ability perform its other constitutional duties. Accordingly the integration and alignment of climate change related measures and other municipal functions are essential.

The fact that the mandate and areas of competence of local government may be expanded in national and provincial legislation also warrants consideration.¹⁶⁸ National and provincial government may allocate additional duties to local government as part of a co-ordinated climate change response. The *Constitution* also entrenches the principle of subsidiarity.¹⁶⁹ The *Constitution* determines that national and provincial government must assign any matter contained in Schedules 4 and 5 to the sphere of local government if the matter would be administered most effectively locally, and if municipalities have the capacity to administer it.¹⁷⁰ This implies that the measures taken in response to climate change that will be most effectively dealt with by local government should be assigned to local authorities. The cumulative effect of these provisions is that national, provincial and local government will need to develop a comprehensive climate change response policy that identifies where and how each sphere of government should become involved in climate change response strategies. Such a policy will *inter alia* need to address the role of local government and the specific interventions local authorities will need to implement.

3.6 Integrated Development Planning and Climate Change

There are several mechanisms by means of which local government can effectively govern its affairs and its community. In post-1996 local government law, particular attention is paid to integrated development planning, which appears to be a key mechanism in relation to specifically developmental local government. For purposes

167 S 237 of the *Constitution*.

168 S 156(1)(b) of the *Constitution*.

169 Subsidiarity is discussed in par 3.1 above.

170 S 156(4) of the *Constitution*.

of this study it merits to briefly dwell on South Africa's integrated development planning system in the local government sphere.

Integrated development planning is a planning approach that is aimed at finding the best possible approaches to ensure the sustainable development of an area. As the name suggests, the planning process must be integrated, meaning that all social, economic, environmental, spatial, cultural, political and any other relevant considerations must be considered in order to ensure the development of a consolidated, strategic, long-term developmental plan.¹⁷¹ Thus integrated development planning may accordingly be used by a local authority in order to regulate the future development of the municipality in a manner that ensures that the municipalities' resources and capacity are used and developed effectively.¹⁷² Integrated development planning is defined as "a form of planning that involves linkage and co-ordination between all sectors of activity that impact on the operation of a local authority."¹⁷³ In light of the developmental role of local government generally, it is clear that this form of planning could generally be used to achieve a higher quality of life in a municipality as a whole. This seems to also have been acknowledged in other countries such as Germany¹⁷⁴ and Namibia.¹⁷⁵

The system of local government planning in South Africa revolves around the development of an Integrated Development Plan (hereafter an IDP) as provided for in chapter 5 of the *Systems Act*. An IDP binds the municipality in the exercise of its executive authority, and it serves as the principal strategic planning instrument that guides all planning and development that takes place in a municipality. It should also guide any municipal decision that relates to planning and development.¹⁷⁶

An IDP is adopted by the Council of a municipality after its election and it must be reviewed and amended annually.¹⁷⁷ According to the *Systems Act* an IDP should link, integrate and co-ordinate plans for development. The plan should align

171 Bouillon *Volhoubare Grondontwikkeling* 93.

172 Bouillon *Volhoubare Grondontwikkeling* 93.

173 Bouillon *Volhoubare Grondontwikkeling* 94.

174 Du Plessis *South Africa's Constitutional Environmental Right* 155.

175 Du Plessis *South Africa's Constitutional Environmental Right* 219.

176 S 35 of the *Systems Act*.

177 S 25 and 34 of the *Systems Act*.

resources and capacity to ensure the implementation of the municipality's developmental objectives. The latter must be realistic. The plan also establishes the policy framework on which annual budgets must be based, and should be aligned with national and provincial developmental plans and legislation of national and provincial government such as the NEMA.¹⁷⁸

The *Systems Act* describes the core components that must form part of an IDP. An IDP must contain the Council's vision for the long-term development of the municipality, and the plan should give priority to the municipality's most critical developmental and internal transformation needs.¹⁷⁹ The plan must assess the current level of development within the municipality, and should identify the communities within the municipality which do not have access to basic municipal services.¹⁸⁰ The IDP should set out the Council's developmental priorities and objectives, and it should indicate its local economic development aims and internal transformation needs.¹⁸¹ It must be aligned with any relevant national and provincial sector plan such as air quality management plans¹⁸² and biodiversity frameworks,¹⁸³ as well as with any planning requirement binding on the municipality in terms of legislation.¹⁸⁴ The IDP should also contain a spatial development framework. The latter must provide guidelines for land use management within the municipal area.¹⁸⁵ The Council must set out its operational strategies in the IDP,¹⁸⁶ and the plan must contain suitable disaster management plans.¹⁸⁷ The plan must also include a financial plan, and the financial plan must contain a budget projection for at least three years.¹⁸⁸ Finally the plan must contain a set of key municipal performance indicators and targets as set out in section 41¹⁸⁹ of the *Systems Act*.¹⁹⁰ Many of

178 S 25(a) of the *Systems Act*.

179 S 26(a) of the *Systems Act*.

180 S 26(b) of the *Systems Act*.

181 S 26(c) of the *Systems Act*.

182 National and provincial air quality plans developed in terms of s 15 of the NEMAQA.

183 The national biodiversity framework as developed in terms of s 38 of the *National Environmental Management: Biodiversity Act* 10 of 2004.

184 S 26(d) of the *Systems Act*.

185 S 26(e) of the *Systems Act*.

186 S 26(g) of the *Systems Act*.

187 S 26(g) of the *Systems Act*.

188 S 26(h) of the *Systems Act*.

189 S 41 deals with municipal performance management systems. It deals with the determination of performance indicators and targets that are meant to measure the performance of municipal functions. These performance management systems can be used to *inter alia*

190 S 26(i) of the *Systems Act*.

these key components are especially important with a view to climate change. The Council's priorities and objectives should be influenced by climate change considerations, and the spatial development framework and land use management plan should hence be conservatively designed in line with the precautionary principle¹⁹¹ and known impacts of climate change. Operational strategies are also of importance as it should indicate how the proposed interventions in the IDP will be implemented.

A local municipalities' IDP must conform to the framework for integrated development planning as adopted by the relevant district municipality. The framework must indicate all of the plans and planning requirements as contained in national and provincial legislation that must be complied with by municipalities.¹⁹² The framework should indicate the matters in the municipalities' IDPs which should be aligned with the district municipality's IDP, and should give guidance on how the alignment should be approached.¹⁹³ The framework should also determine procedures for consultations between the municipalities during the drafting of their respective IDPs, and should also indicate the process to be followed should the framework be amended. A local municipality's IDP must in addition be aligned with any other developmental plans or policies of provincial and/or national government.¹⁹⁴ The alignment between the IDPs of district and local municipalities is of relevance because climate change response measures, by necessity and due to its variety of facets, must be integrated. Accordingly it is essential that district and local municipalities develop their climate change response strategies in consultation with each other.

Clearly, an IDP is meant to serve as the principal planning instrument that should ensure that a municipality achieves its constitutional objectives. It guides development and decision making in a municipality and it is binding on the executive authority of the relevant municipality.

191 See para 4.1 and 5.1 below.

192 S 27(2)(a) of the *Systems Act*.

193 S 27(2)(b)&(c) of the *Systems Act*.

194 The *Systems Act* also contains guidelines for the process that must be followed during the adoption of an IDP. The process need not be discussed in detail, but it should be noted that the adoption process has been designed with the principles of public participation in mind, and that the development of an IDP is an all inclusive process that allows stakeholder involvement.

Integrated development plans or IDPs have the potential to serve as the primary planning tool for local government's actions towards climate change mitigation and adaptation. It contains municipalities' developmental objectives and priorities and describes the interventions necessary to achieve those objectives. Thus it is also suited to contain municipalities' priorities, objectives and implementation measures with relation to the different components or facets of climate change. In addition, the IDP contains land use management plans, operational strategies and the municipal budget; these instruments all need to acknowledge and provide for measures towards mitigation of and adaptation to climate change in order to ensure an effective response to the phenomena. Hence it is argued that the IDP could serve as the primary planning tool in which municipalities address climate change. This view will arguably prove even truer if district municipalities' frameworks for integrated development are used to guide the district's climate change response generally, while the local municipalities' IDPs contain the specific measures needed to give effect to the district's climate change objectives.

Current policy discussions on local government and climate change also show a need to integrate climate change measures into municipal IDPs.¹⁹⁵ However, for several reasons, municipalities face challenges in effectively addressing climate change in their IDPs. These include the lack of a political and legal mandate to address climate change; trouble in determining the ownership of responsibilities with relation to climate change; and uncertainty in terms of the exact implications of climate change for local government.¹⁹⁶ These challenges are returned to in paragraph 6 below.

195 SALGA *Local Government Climate Change Discussion Document 2*. Some municipalities have already integrated climate change considerations into their development planning. These municipalities *inter alia* include the City of Cape Town, eThekweni and Johannesburg that have developed various adaptation and mitigation plans. See SALGA *Local Government Climate Change Discussion Document 15*.

196 SALGA *Local Government Climate Change Discussion Document 44*. Other challenges identified by local authorities include; the implementation of the clean development mechanism (see par 4.1.2 for a further discussion thereof), and finding a balance between mitigation and adaptation measures. SALGA's report shows that municipalities tend to focus on climate change mitigation, while adaptation is neglected due to *inter alia* uncertainties of the municipalities' vulnerabilities to the impacts of climate change. Municipalities also identified capacity constraints and insufficient resources, an overall lack of research on climate change, lack of integrated development planning, and lack of leadership on climate change issues.

3.7 Conclusion

From the above it is clear that the local sphere of government plays a crucial role in development, service delivery and governance, including environmental governance of the South African state. An inclusive reading of paragraphs 2 and 3 above further highlights that local government and the constitutional framework governing it, by nature implies that climate change is an issue at and for the local sphere of government.

It is however one thing to discuss climate change as a phenomena on the one hand and the changing face of South Africa's local government, on the other. The point is that apart from the broad environmental objectives of local government in the *Constitution* and *Systems Act*, South Africa's local government increasingly incurs international law duties in relation to climate change. The "state's" acceptance of climate change law simultaneously results in duties of sub state organs such as local government. The next section of this study turns to this issue.

4 South Africa's duties with regard to climate change

South Africa is a party to the UNFCCC as well as the *Kyoto Protocol to the United Nations Framework Convention on Climate Change*¹⁹⁷ (hereafter the *Kyoto Protocol*). These treaties contain obligations and principles that are binding on South Africa and that govern the international community's climate change response. In the first part of this section these obligations and principles will be briefly discussed, with the aim to determine which duties should be addressed by government – with the inclusion of municipalities. In the second part of this section these identified international duties, will be discussed in the light of the implications of climate change as was addressed in paragraph 2 above. The primary objective is to determine the potential role of local authorities in South Africa's execution of its international law duties. The said discussion will highlight the possible roles of local government in the country's climate change response.

¹⁹⁷ *Kyoto Protocol to the United Nations Framework Convention on Climate Change* (1998).

4.1 International law

International law can be defined as the body of rules and principles which is binding upon states, and that governs their relationship with one another.¹⁹⁸ International environmental law is the complete set of international rules regulating and protecting the environment.¹⁹⁹ It contains legally binding principles and obligations derived from customary rules and conventions, as well as treaties such as the UNFCCC and the *Kyoto Protocol*.

The *Constitution* prescribes when and how international law may become legally binding in South Africa. It determines that international law may have the force of law if it is consistent with the principles contained in South Africa's statutes and the *Constitution*.²⁰⁰ Section 231 of the *Constitution* regulates the incorporation of international agreements into domestic law; it determines that the national executive may sign international agreements on behalf of South Africa.²⁰¹ These agreements become binding after ratification by the National Assembly and the National Council of Provinces.²⁰² International agreements become legally binding when enacted into law by national legislation, while a self-executing provision of an agreement becomes law after approval by Parliament.²⁰³ The UNFCCC and *Kyoto Protocol* are meant to be self-executing and therefore became legally binding in South Africa after their ratification.²⁰⁴

At this stage it is important to take note of the fact that there are currently negotiations under way for the development of further commitments under the UNFCCC and the *Kyoto Protocol*. The negotiations will be completed at the 15th Conference of the Parties²⁰⁵ (hereafter the COP). The COP will be held in Copenhagen during December 2009 and is intended to culminate in an agreement covering further commitments under the *Kyoto Protocol*, the agreement is intended

198 Dugard *International Law* 1.

199 Kiss and Shelton *Handbook on Environmental Law* 3.

200 S 232 of the *Constitution*.

201 Glazewski *Environmental Law* 585.

202 S 231(2) of the *Constitution*.

203 S 231(4) of the *Constitution*.

204 See Dugard *International Law* 60-61 for further discussion on the ratification of international law.

205 Conference of the Parties refers to the parties to the UNFCCC.

to *inter alia*; enhance national and international mitigation action; to enhance adaptation action; to enhance technology transfer; as well as a future vision to address climate change; and finally to enhance action for the provision of financial resources to address climate change.²⁰⁶

Although the outcome of the Copenhagen COP could have an impact on the international position on climate change, the measures in the UNFCCC and the *Kyoto Protocol* will remain be relevant as the UNFCCC and the *Kyoto Protocol* provide the framework that contains the general principles with regard to mitigation, adaptation, international cooperation including technology transfer, funding, and a shared universal vision.

4.1.1 United Nations Framework Convention on Climate Change

During the 1992 Rio Earth Summit the UNFCCC was adopted to address the challenge of climate change. South Africa signed the UNFCCC during 1993 and ratified it in 1997.²⁰⁷ The UNFCCC is the principal legal framework governing the international community's response to climate change.

The ultimate objective of the UNFCCC is stated as follows:²⁰⁸

To achieve, in accordance with the relevant provisions of the Convention, stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

The main objective of the UNFCCC, the *Kyoto Protocol*, and any new agreements that will be concluded in Copenhagen therefore seem to be aimed at stabilising the amount of greenhouse gases in the atmosphere to a level that would prevent dangerous human (anthropogenic) changes in the earth's climate system. But the objective does not itself make clear what "dangerous anthropogenic interference with the climate system" means, nor does it provide a definite limit on the total

206 UNFCCC 2009 <http://unfccc.int/2860.php>.

207 UNFCCC 2009 <http://unfccc.int/2860.php>.

208 A 2 of the UNFCCC.

permissible amount of greenhouse gases in the atmosphere. Clearly scientific knowledge is needed to determine the acceptable levels of emissions as the objective allows emission levels to be limited as required as new scientific knowledge and advances require.²⁰⁹ Provision is hence tacitly made for application of the precautionary principle²¹⁰ as an acknowledged principle in international environmental law. The focus of the UNFCCC is on mitigation and not adaptation, even though adaptation is also acknowledged as a crucial part of the international climate change response. Be it as it may states are expected to effectively address mitigation *inter alia* in its planning and environmental governance efforts.²¹¹

The UNFCCC contains a set of guiding principles in the light of which the UNFCCC's objectives should be attained. It determines that the climate system should be protected "for the benefit of present and future generations of humankind" while the common but differentiated responsibilities and capabilities of the parties are taken into account.²¹² The principles also state that the parties to the convention should take precautionary measures to anticipate, prevent or minimise the causes of climate change and mitigate its adverse effects.²¹³ The Convention acknowledges that the parties have the right to promote sustainable development in the steps they take to respond to climate change, and it requires that policies to protect the climate system against human-induced change should be integrated into parties' national development programmes.²¹⁴ The duty to include climate change-related measures into developmental programmes must arguably be understood as a duty of state governments to estimate the best suitable levels and mechanisms for the design and implementation of development plans.

Article 4 of the UNFCCC contains a list of commitments that must be fulfilled. South Africa and other state parties must *inter alia* publish a national communication to the

209 UNFCCC Handbook 23.

210 On the precautionary principle see further Kidd *Environmental Law* 33 and the discussion of the national environmental management principles in par 5 hereunder.

211 See the definitions of environmental governance and local environmental governance as discussed in par 3.1 above.

212 A 3(1) of the UNFCCC. This provision reflects the notion of environmental justice. For further reading on environmental justice in the context of climate change see Ikeme *Global Environmental Change* 195-196.

213 A 3(3) of the UNFCCC. This provision symbolises the precautionary principle in international environmental law. For a further discussion of the precautionary principle see par 5.1 hereunder.

214 A 3(4) of the UNFCCC.

conference of the parties.²¹⁵ The communication must contain a national inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases,²¹⁶ and a summary of the steps that have been taken to achieve the aims of the UNFCCC.²¹⁷ South Africa published its Initial National Communication under the UNFCCC on 11 December 2003, and has initiated a public participation process for the development of the country's Second National Communication to be completed during May 2010.

Article 4(1)(b) commits South Africa to implement national and regional programmes containing measures to mitigate climate change by limiting the release of greenhouse gases by sources, while promoting the removal of greenhouse gases by sinks.²¹⁸ The same article determines that measures must be implemented to facilitate adequate adaptation²¹⁹ to climate change.²²⁰

Article 4(1)(c) compels South Africa to promote and cooperate in the development of technologies, practices and processes to minimise the emission of greenhouse gases in all sectors.²²¹ South Africa must promote and cooperate in the research, development and exchange of scientific, technological, technical, socio-economic and other studies related to the climate system and climate change,²²² and must cooperate in the prompt and full exchange of climate change-related information between the parties.²²³ Parties to the UNFCCC are also required to promote and cooperate in the education, training and public awareness of climate change issues, and they should ensure that a wide participation process is followed in climate change-related actions. Article 6 further requires the promotion of education, training and public awareness of climate change on a national, regional and sub-regional level, and requires that scientific, technical and managerial personnel are trained with regards to climate change. The sustainable management, conservation and

215 A 4(1)(a) of the UNFCCC.

216 A 12(1)(a) of the UNFCCC.

217 A 12(1)(b) of the UNFCCC.

218 Sinks and reservoirs were discussed in par 2 above.

219 Adaptation and adaptation techniques were discussed in par 2 above.

220 A 4(1)(b) of the UNFCCC.

221 This will include the energy, transport, industry, agriculture, forestry and waste-management sectors.

222 A 4(1)(g) of the UNFCCC.

223 A 4(1)(h) of the UNFCCC.

enhancement of sinks and reservoirs of all greenhouse gases must be promoted. This must include the conservation of biomass, forests and oceans as well as other coastal and marine ecosystems.²²⁴

Section 4(1)(e) requires that preparations must be made to adapt to the effects of climate change, and compels the state parties to develop and elaborate integrated plans for the management of coastal zones, water resources and agriculture, and for the protection and rehabilitation of areas affected by drought, desertification and floods. State parties are also required, as far as it is feasible to do so, to take climate change considerations into account in their relevant social, economic and environmental policies and actions.²²⁵

The *Kyoto Protocol* will be discussed below. It is an addition to the UNFCCC and it is meant to extend and strengthen the provisions of the UNFCCC by setting definite targets meant to ensure that the objectives contained in the UNFCCC are achieved.

4.1.2 *The Kyoto Protocol*

South Africa ratified the *Kyoto Protocol* on 31 July 2002. It came into effect on 14 February 2005. The Protocol has the same objective as the UNFCCC. It is meant to achieve the stabilisation of greenhouse gas concentrations in the atmosphere to a level that would prevent dangerous anthropogenic interference with the earth's climate system.²²⁶

The Protocol attempts to address the release of greenhouse gases by assigning a limit to the amount of greenhouse gases Annex 1 countries²²⁷ may release annually.²²⁸ Countries are placed into categories based on the level of their development by the annexes to the Protocol.²²⁹ Currently South Africa is

224 A 4(1)(d) of the UNFCCC.

225 A 4(1)(f) of the UNFCCC.

226 Objective as stated in A 2 of the UNFCCC.

227 The list of Annex 1 countries consists out of the major industrialised countries, and countries in transition to become market economies. The list of non-Annex 1 countries consist of a list of developing countries. UNFCCC Handbook, 46.

228 A 3 of the *Kyoto Protocol*. The reduction to the set limit must be achieved in the commitment period 2008-2012.

229 Annex 1 and 2 of the *Kyoto Protocol*.

categorised as a non-Annex 1 party and it does not have an obligation to reduce its greenhouse gas emissions to a predetermined level. It is, however, possible that South Africa will have to make an emission reduction commitment in the future, as it is one of the largest emitters of greenhouse gases in Africa.²³⁰ At this stage it is unclear when South Africa will commit to its first emission reduction targets, but it is unlikely that it will accept any emission reduction target in the next UNFCCC commitment period. In a recent message by President Jacob Zuma to the UN Secretary General, the President stated that: "We need to acknowledge and maintain the distinction between the responsibilities of developed countries and those of developing countries."²³¹ It appears as if, at least at a political level South Africa is at this point not willing to accept emission reduction targets. Certainty on this point may be achieved only after the conference of the parties is completed at Copenhagen at the end of this year.

South Africa's main obligations in terms of the *Kyoto Protocol* are contained in Article 10. Article 10 does not impose any new responsibilities on non-Annex 1 countries like South Africa, but reaffirms and qualifies their duties as contained in the UNFCCC.²³²

The UNFCCC confirms South Africa's duty to formulate, where relevant and to the extent possible, cost-effective national and, where appropriate, regional programmes to improve the quality of local emission factors.²³³ This means that programmes must be put in place which will improve air quality, and that will reduce the amount of greenhouse gases released into the atmosphere. South Africa should also formulate, implement, publish and regularly update national and, where appropriate, regional²³⁴ programmes containing measures to mitigate and facilitate adequate adaptation to climate change.²³⁵ The Protocol goes further by identifying certain sectors (although it is not an exclusive list) in which mitigation and adaptation

230 Glazewski *Environmental Law, South Africa* 589.

231 *Message by South African President Jacob Zuma to the UN Secretary General's High Level Summit on Climate Change* 22 September 2009. Statement is available at DEAT's website at <http://www.environment.gov.za/>.

232 A 10 of the *Kyoto Protocol*.

233 A 10(a) of the *Kyoto Protocol*.

234 In this context regional refers to larger regions like Africa and Europe.

235 A 10(b) of the *Kyoto Protocol*.

measures should be implemented. The identified sectors are the energy, transport, industry, agriculture, forestry and waste-management sectors.²³⁶ The Protocol also makes specific reference to the fact that adaptation technologies and methods should be contained in spatial planning measures to ensure adequate adaptation to climate change.²³⁷

The Protocol reaffirms the state's duty to develop and use environmentally sound, technologies, practices, technical know-how and processes with regards to climate change, as well as steps to enable the private sector to develop such technologies.²³⁸ South Africa must research and cooperate in scientific and technical research with regards to the climate system, and must study the possible economic and social consequences of various response strategies to climate change.²³⁹ Steps should be taken to develop education and training programmes to facilitate public awareness and public access to information with regards to climate change.²⁴⁰ Lastly a national communication should be made containing information on programmes and activities undertaken in terms of Article 10.²⁴¹

The *Kyoto Protocol* also creates the clean development mechanism.²⁴² The purpose of the clean development mechanism (hereafter referred to as the CDM) is to assist parties not included in Annex I, like South Africa, to achieve sustainable development and to combat climate change, while it assists Annex 1 countries to meet their more stringent obligations in terms of the Protocol.²⁴³ The working of the mechanism allows an Annex 1 country to assist non-Annex 1 countries to achieve sustainable development and to reduce their carbon emissions.²⁴⁴ The mechanism works as follows: when an Annex 1 country assists a country to reduce its carbon emissions with a CDM project, the assisting country is given credit for the emission reduction. Thus the reduction achieved can subsequently be used to achieve the Annex 1 country's emission reduction aims.

236 A 10(b)(i) of the *Kyoto Protocol*.

237 A 10(f) of the *Kyoto Protocol*.

238 A 10(c) of the *Kyoto Protocol*.

239 A 10(d) of the *Kyoto Protocol*.

240 A 10(e) of the *Kyoto Protocol*.

241 A 10(f) of the *Kyoto Protocol*.

242 A 12(1) of the *Kyoto Protocol*.

243 A 12(2) of the *Kyoto Protocol*.

244 A 12(3)(b) of the *Kyoto Protocol*.

It is clear that the UNFCCC and *Kyoto Protocol* place several duties on the South African government in its totality. The implications of these duties for local authorities in particular, are subsequently considered.

4.2 Duties and obligations: Implications for local authorities

As was shown above, international climate change law measures must be implemented and developed in South Africa. As was indicated above, for different reasons, the international law duties often translate into obligations for sub-state organs such as provinces and local authorities.

South Africa is required to take internationally entrenched climate change considerations into account in its social, economic and environmental policies and actions.²⁴⁵ National, provincial and local authorities all incur duties towards climate change in terms of the applicable international law instruments. Local authorities seem to be obliged to consider climate change in all their social, economic and environmental policies and actions. As was explained in paragraph 3.6 IDPs are the principal planning tool in local governance.²⁴⁶ Due to the vast long-term and potential use of IDPs it is argued that all local authorities must integrate climate change considerations into their policies and actions as planned in the IDP. Climate change may in some areas even be expected to be a focus point in the IDP of a municipality.

The South African government should implement measures to mitigate climate change. The *Kyoto Protocol* determines that these measures must be designed in and for the energy, transport, industry, agriculture, forestry and waste-management sectors.²⁴⁷ The list determined in the *Kyoto Protocol* is not exclusive. Mitigation should also take place in the latter sectors. Land use planning is very important as it relates to the conservation of sinks,²⁴⁸ urban density,²⁴⁹ and a range of other relevant

²⁴⁵ A 4(1)(f) of the UNFCCC.

²⁴⁶ See par 3.5 above.

²⁴⁷ A 10(b)(i) of the *Kyoto Protocol*.

²⁴⁸ As stated previously a sinks refers to processes and organisms that remove greenhouse gases from the atmosphere. This includes biomass, trees and forests. The conservation, sustainable management and enhancement of sinks is required in A 4(1)(d) of the UNFCCC.

considerations.²⁵⁰ The building sector is another sector with much mitigation potential, as the IPPC reports indicate that changes in building methods and planning may lead to significant greenhouse gas reductions.²⁵¹ Several of these sectors fall within the constitutional areas of competence of local government as contained in Schedules 4(B) and 5(B) of the *Constitution*. This includes the air quality, energy, transport, waste-management and land-use sectors, as well as the building sector. Air quality falls exclusively within the governing power of municipalities in South Africa. Air quality management has the potential to mitigate greenhouse gas emissions;²⁵² hence, in this context, the important role of local government in climate change mitigation cannot be disregarded.

In addition to its duty to mitigate, the South African government must also implement measures to ensure adequate adaptation to climate change. The UNFCCC identifies the following adaptation priority areas: coastal zones, water resources, agriculture and the protection and rehabilitation of areas affected by drought, desertification and floods.²⁵³ The *Kyoto Protocol* also requires that adaptation measures must be integrated into spatial planning.²⁵⁴ In accordance with their constitutional areas of competence, it appears as if local authorities in South Africa will have a particularly important role to play in adapting to climate change. Local authorities have jurisdiction over disaster management, coastal zones²⁵⁵ and spatial planning. These authorities will need to implement adaption strategies for each of these sectors. In addition to what has already been discussed, the IPPC²⁵⁶ identified the following sectors that fall within the ambit of local authorities' mandate: water resources,²⁵⁷ human health, and tourism. This means that local authorities should develop appropriate adaptation strategies in response to all expected climate change

249 Denser developed urban areas reduce the need to travel, thereby reducing greenhouse gas emissions. Hamin and Gurran *Habitat International* 1.

250 Hamin and Gurran *Habitat International* 242.

251 Barker "Summary for Policymakers" 11.

252 UNFCCC *Handbook* 79. For example, the release of greenhouse gases may be reduced by managing emissions from industries.

253 A 4(1)(c) of the UNFCCC.

254 A 10(f) of the *Kyoto Protocol*.

255 There are various coastal municipalities that govern the coastline directly or indirectly these include the City of Cape Town Metropolitan Municipality and Ekurhuleni Metropolitan Municipality.

256 Discussed at par 2.2 above.

257 To the extent that it relates to "water and sanitation services limited to potable water supply systems and domestic waste-water and sewage disposal systems" as identified in Schedule 4 (B) of the *Constitution*.

impacts; in the formulation of such strategies local authorities should ensure that due consideration is given to the interventions as identified by the UNFCCC above.

South Africa has the duty to compile national communications containing a summary of greenhouse gas emissions and reductions, it should gather data on climate change, and must to cooperate in the development and research of climate change-related information and technologies.²⁵⁸ Local authorities as air quality control authorities accordingly have a particularly important role in collecting and retaining information on greenhouse gas emission levels, amongst other.

The principle of sustainability,²⁵⁹ environmental justice and the precautionary principle are highlighted in the UNFCCC. All parties should implement these principles in order to protect the climate system for the benefit of present and future generations of humankind.²⁶⁰ The Convention also implores countries to promote sustainable development.²⁶¹ Sustainable development is important as research by the IPPC shows that "making development more sustainable by changing development paths can make a major contribution to climate change mitigation."²⁶² Thus South Africa and its local authorities should implement and promote sustainable development.²⁶³ The UNFCCC fails to clarify where and how sustainable development should be implemented. However, there is a range of international instruments that deal with sustainable development; this includes Agenda 21 to *Rio Declaration on the Environment and Development*²⁶⁴ that sets out the international communities approach to sustainable development. It is expected that the principles contained therein should guide the implementation of sustainable development in the context of climate change.²⁶⁵

258 A 4(1)(g) of the UNFCCC.

259 The principles of sustainable development and sustainability were discussed at par 2.4 above.

260 A 3(1) of the UNFCCC.

261 A 3(4) of the UNFCCC.

262 Barker "Summary for Policymakers" 21.

263 See para 2.4 above.

264 *Agenda 21 of the United Nations Conference on Environment and Development* (1992).

265 Chapter 28 of *Agenda 21* contains reference to the so called Local Agenda 21. It encourages the development of local plans of action that set out how sustainable development will be implemented on a local level. In these plans of action could also be used to implement sustainable development as part of an integrated response to climate change.

Parties to the UNFCCC are required to promote and cooperate in education and training on, and public awareness of climate change. Local government can for different reasons have an important role in education and training. As the sphere of government closest to the people it is well situated to educate the local community on climate change. Local authorities are also well suited to ensure that the public participate in managing climate change. The development of an IDP, for example, has various opportunities for public participation. Capacity building is also essential to ensure that local government decision makers and administrators are able to implement the necessary climate change-response measures. This implies that municipalities will need to take pro-active measures to educate its decision makers and administrators; and national and provincial government will also need to facilitate this process by providing local government with the necessary support and training.

It is also strongly argued that CDM should be promoted and implemented as far as possible. As explained above, the CDM has been designed to enable non-Annex 1 countries to reduce their greenhouse gas emissions with the assistance of Annex 1 countries. The Department of Minerals and Energy²⁶⁶ (hereafter referred to as the DME) has been declared as lead authority for the CDM²⁶⁷ in terms of section 25(3) of NEMA. The DME has several CDM projects in different stages of development, and has received credit for the effective implementation of the Kuyasa low-cost housing energy upgrade project.²⁶⁸

South African municipalities are also in the process of implementing CDM projects,²⁶⁹ and it is suggested that all local authorities should consider implementing the CDM mechanism in their municipalities.²⁷⁰ The development of CDM projects has been identified as one of the options through which local authorities can

266 Take note that the Department of Minerals and Energy have been re-aligned into two new departments known as: the Department of Mineral Resources and the Department of Energy. It is expected that the newly formed Department of Energy will take over the lead role in the development of further CDM projects.

267 GN 721 in GG 27788 of 22 July 2005.

268 For further information on Kuyasa and other CDM projects see the Designated National Authority 2005 <http://www.dme.gov.za/> 10 Oct.

269 SALGA *Local Government Climate Change Discussion Document* 17. Ekurhuleni Metropolitan Municipality and the City of Johannesburg Metropolitan Municipality both have landfill gas projects in different stages of development for example.

270 The development of CDM projects has various advantages, it can reduce electricity usage and demand, thereby saving money, and reduce local air pollution for example. See Strydom and King (eds) *Environmental Management* 1068.

contribute to climate change mitigation.²⁷¹ SALGA suggested that local authorities should consider the option of developing CDM projects in partnership with other municipalities and the private sector.²⁷² Such an approach makes sense as it allows municipalities to combine resources, knowledge and certified emission reductions in order to register CDM projects.²⁷³

4.3 Conclusion

It has been shown that the international legal framework compels South Africa to implement several measures in response to climate change. Several of these measures will need to be implemented by local authorities as they squarely fall within the constitutional mandate of local government. The challenge or even problem may be that mere constitutional assignment of related functional areas of power are not enough to equip local government in going further with the climate change mitigation/adaptation mandate and international law duties. The next section explores the extent to which the South African environmental law facilitates or could facilitate local environmental governance towards an effective climate change response, generally.

5 South African environmental law

As was shown above, local government should, judged by its powers and functions be expected to be involved in the implementation of a variety of measures in response to climate change. An analysis of the exact scope and extent of these measures in the light of the entire body of environmental law falls outside the scope of this study. This section focuses on a single facet of an effective climate change response, being air-quality management. Whether or not South African law has been designed, generally to assist local government in responding to climate change, is therefore judged by looking at the legal framework pertaining to air quality management specifically.

Air-quality management was chosen for this discussion for various reasons:

²⁷¹ SALGA *Local Government Climate Change Discussion Document* 26.

²⁷² SALGA *Local Government Climate Change Discussion Document* 26.

²⁷³ It is possible to bundle a range of smaller greenhouse gas emission reduction projects together in order to register a certified CDM project.

In *South Africa's Initial National Communication under the United Nations Framework Convention on Climate Change*, NEMAQA is identified as the framework law that will regulate air quality,²⁷⁴ and thus climate change in so far as the former relates directly to air quality. NEMAQA came into full effect on 11 September 2009.²⁷⁵ NEMAQA places several duties on local governments with relation to air quality, and its provisions give an indication of the government's latest thinking on climate change and air quality. In addition there are several links between air quality management and climate change adaptation, mitigation and information gathering, as discussed above.²⁷⁶ This section accordingly reviews South Africa's environmental legislative and policy framework with specific reference to the role and function of local government in matters relating to air quality management.

5.1 NEMA

NEMA serves as South Africa's environmental framework legislation.²⁷⁷ It was designed to provide for co-operative and integrated environmental governance by establishing a general framework for decision-making on matters affecting the environment.

NEMA provides a set of overarching environmental principles. These principles "apply throughout the Republic to the actions of all organs of state that may significantly affect the environment."²⁷⁸ It is important to realise that although NEMA establishes a national law framework its provisions also apply in each municipal jurisdiction. The principles apply in conjunction with all other appropriate and relevant considerations. These include the State's responsibility to respect, protect, promote and fulfil the social and economic rights contained in section 2 of the *Constitution*.²⁷⁹ It serves as guidelines in terms of which governmental functions affecting the environment and legislation managing and protecting the environment

274 *Initial National Communication under the United Nations Framework Convention on Climate Change* 15. As published on 11 December 2003.

275 SAAQIS 2009 <http://www.saaqis.org.za/>.

276 See para 2.1, 2.2 and 4.3 above.

277 Nel and Du Plessis *SAJELP* 35.

278 S 2(1) of NEMA.

279 S 2(1)(a) of NEMA.

must be interpreted and applied.²⁸⁰ These principles also apply to all actions taken by South Africa's local authorities that will have significant environmental impacts. These principles should guide any further measures, be it executive or legislative, taken by local authorities in response to climate change.

The principles state, *inter alia*, that environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.²⁸¹ NEMA also acknowledges the principle of sustainable development. It determines that development must be socially, environmentally and economically sustainable.²⁸² The acknowledgement of the principle of sustainable development is of special importance as it links directly with the principle of sustainability as contained in the UNFCCC.²⁸³

Because of the importance of sustainable development some of the principles of NEMA must be considered briefly. The disturbance of ecosystems, the loss of biological diversity, environmental degradation and pollution must be avoided, and where they cannot be avoided they must be minimised and remedied.²⁸⁴ This implies that local authorities should implement measures to reduce pollution and protect the environment. As climate change is expected to adversely affect *inter alia* ecosystems and biodiversity, measures must be taken in response to this perceived threat. The precautionary principle is also included, meaning that a "risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions."²⁸⁵ This principle is very important as the exact extent and impacts of climate change is still unsure. Municipalities should follow a risk-averse approach in areas such as land use management, for example and be prepared to mitigate and adapt to climate change and its implications by means of building regulations and transport planning, for example. Finally, negative impacts on the environment and people's environmental

280 S 2(1)(c) and (e) of NEMA.

281 S 2(2) of NEMA.

282 S 2(3) of NEMA.

283 A 3 of the UNFCCC. As discussed above at par 4.1.1 above.

284 S 2(4)(a)(i) and (ii) of NEMA.

285 S 2(4)(a)(vii) of NEMA.

rights must be anticipated, prevented, avoided and minimised.²⁸⁶ This principle may be of importance in the provision and maintenance of water and health services, for example.

NEMA's guiding principles also determine that environmental management must be integrated,²⁸⁷ and that there must be inter-governmental co-ordination and harmonisation of policies, legislation and actions relating to the environment.²⁸⁸ The principles also provide that an all-inclusive decision-making process must be followed on matters relating to the environment,²⁸⁹ and that access to information must be ensured.²⁹⁰ These principles have similarities with the general principles contained in article 3 of the UNFCCC.²⁹¹ Both the UNFCCC and NEMA contain the principles of sustainable development,²⁹² the precautionary principle,²⁹³ and the duty to prevent and mitigate environmental damage.²⁹⁴ Thus the principles in NEMA entrench most of the general principles contained in the UNFCCC. There is accordingly a link between the general environmental management principles applicable to every sphere of government as contained in NEMA and South Africa's international law duties with relation to climate change. These principles should therefore guide *inter alia* local authorities in the implementation of measures in anticipation of climate change.

Furthermore, global and international responsibilities relating to the environment must be discharged in the national interest.²⁹⁵ This principle relates to the application of the UNFCCC and the *Kyoto Protocol*, and accepts that South Africa has international obligations that are of importance to the environment. It also qualifies how South Africa should comply with its international obligations, as it determines that these obligations must be discharged in the national interest. This

286 S 2(4)(a)(viii) of NEMA.

287 S 2(b) of NEMA.

288 S 2(l) of NEMA.

289 S 2(l) of NEMA.

290 S 2(l) of NEMA.

291 See par 4.1.1 above.

292 A 3.1 of the UNFCCC and s 2(3) of NEMA.

293 A 3.2 of the UNFCCC and s 2(4)(a)(vii) of NEMA.

294 A 3.2 of the UNFCCC and s 2(4)(a)(i), (ii) and (viii) of NEMA.

295 S 2(4)(n) of NEMA.

means that South Africa's climate change mitigation and adaptation responses should benefit local communities, and not merely the international community.

NEMA also makes provision for integrated environmental management by introducing environmental impact assessments (hereafter referred to as an EIA).²⁹⁶ In terms of section 24 the Minister or MEC may identify certain activities which may not be conducted without an environmental authorisation.²⁹⁷ Such authorisation may be granted only after the environmental impacts of certain activities have been considered, investigated, assessed and reported to the authority charged with granting the relevant environmental authorisation.²⁹⁸ The EIA process is important as it also relates to the authorisation process that must be followed in terms of NEMAQA that will be discussed hereunder.²⁹⁹ EIAs can potentially serve as effective tools with which climate change considerations can be incorporated into decisions (including decisions by local authorities) that may affect the environment. The EIA process also makes provision for stakeholder involvement; among others, local authorities and councillors must be involved, and their comments on a proposed development must be considered.³⁰⁰ Local authorities must be involved in EIA processes, and they should ensure that developments correspond with their long-term planning. In the light of this it is suggested that local authorities include climate change considerations in their IDPs and use planning processes to decide whether or not they should approve of or oppose a proposed development.³⁰¹

The initial EIA Regulations³⁰² under section 24 of NEMA made no special provision for climate change and did not include it as a consideration to be taken into account for an environmental authorisation. In 2008 the Minister published the *Second Amendment Draft to the EIA Regulations*.³⁰³ In this draft, climate change was listed as a factor that must be taken into account when an application for environmental authorisation is considered.³⁰⁴ However, the newest *Draft Environmental Impact*

296 S 24 of NEMA.

297 S 24(2)(a) of NEMA.

298 S 24(1) of NEMA.

299 See par 5.2.2 below.

300 Aucamp *Environmental Impact Assessment* 51.

301 IDPs were discussed in par 3.6 above

302 GN 385 in GG 28753 of 21 April 2006.

303 GN 658 in GG 31144 of 13 June 2008.

304 GN 658 in GG 31144 of 13 June 2008.

*Assessment Regulations*³⁰⁵ are void of any climate change consideration.³⁰⁶ Should this draft be accepted, climate change will not *per se* be considered as a factor for determining whether an authorisation should be granted.³⁰⁷ It must be emphasised, however, that due to its constitutional functions, climate change will have to be an implicit factor for consideration by local government in the review of any development that may impact on, or relate to, the functional areas contained in Schedules 4(B) and 5(B).³⁰⁸

Section 25 of NEMA allows the Minister³⁰⁹ to introduce legislation or regulations which are necessary to give effect to an international environmental instrument to which the Republic is a party. Thus the Minister may introduce legislation or regulations to fulfil South Africa's international responsibilities with regard to climate change.³¹⁰ The Minister has a wide discretion regarding the nature of the legislation and regulations that are introduced. In short, provision is made for the implementation of any measure that is necessary to give effect to the international instrument.³¹¹ Therefore it is clear that section 25 gives the Minister more than sufficient power to take active steps to achieve the aims of the UNFCCC and the *Kyoto Protocol*. These steps may well have implications for local authorities. For example, the Minister may require local authorities to include climate change considerations in their IDPs.

5.2 NEMAQA

NEMAQA is meant to reform the law that regulates air quality in South Africa. The Act introduces measures to prevent pollution and secure sustainable development, and is meant to improve air quality by providing norms and standards for regulating

305 GN 165 in GG 31855 of 13 Feb 2009.

306 S 8 of GN 165 in GG 31855 of 13 Feb 2009.

307 This position is regrettable as the EIA is an excellent tool with which climate change considerations could have been included in decisions that have significant environmental impacts. The inclusion of climate change as a consideration in the EIA process has great potential to ensure that steps are taken to mitigate and adapt to climate change, and the failure to include it is deplorable.

308 See par 3.5 above.

309 Minister of Water and Environment Affairs.

310 S 25(3) of NEMA.

311 S 25(3)(h) of NEMA.

air quality monitoring, management and control in all spheres of government.³¹² The preamble to NEMAQA states that "atmospheric emissions of ... greenhouse gases and other substances have deleterious effects on the environment both locally and globally" and that additional measures are necessary to ensure that air quality is improved through the minimisation of air pollution. The objectives of NEMAQA are to protect and enhance air quality in South Africa,³¹³ to prevent air pollution and ecological degradation³¹⁴ and to secure ecologically sustainable development.³¹⁵ The Act is binding on the national, provincial and local spheres of government.³¹⁶ Organs of state (including local authorities) have the duty to apply NEMAQA and to progressively enhance South Africa's air quality.³¹⁷ It may hence be expected that in principle the NEMAQA will facilitate local governments' response to climate change in as far as it relates to air quality management.

5.2.1 The air quality management framework and climate change

Chapter 2 of NEMAQA establishes a national framework for air quality management. The Act requires the Minister to establish a national framework which should guide the implementation of the Act and which should ensure that its objectives are achieved.³¹⁸ The existing national framework is binding on all organs of state and all spheres of government³¹⁹ and may assign and delineate responsibilities for the implementation of NEMAQA amongst the different spheres of government and organs of state.³²⁰ The framework was published on 11 September 2007 in the *Government Gazette* (hereafter referred to as the NF).³²¹

The NF contains measures to achieve the objectives of NEMAQA, these include: Mechanisms, systems and procedures to attain compliance with ambient air quality

312 Preamble to NEMAQA.

313 S 2(a)(i) of NEMAQA.

314 S 2(a)(ii) of NEMAQA.

315 S 2(a)(iii) of NEMAQA.

316 S 4(2)(a) and (b) of NEMAQA.

317 S 3 of NEMAQA.

318 S 7(1) of NEMAQA.

319 S 7(3)(a) of NEMAQA.

320 S 7(3)(b)(i) and (ii) of NEMAQA.

321 GN 1138 in GG 30284 of 11 September 2007.

standards³²² and which give effect to South Africa's obligations in terms of international agreements.³²³ It contains national norms and standards for air quality monitoring, air quality management planning and information management. The NF contains measures to ensure that data is collected and managed to assess compliance with the provisions of NEMAQA; air quality and emission standards; air quality management plans; and the Republic's international obligations.³²⁴ The NF also establishes national standards for municipalities to monitor ambient air quality and emissions from point, non-point and mobile source emissions.³²⁵

The norms and standards that are established by the NF must ensure that certain objectives are met. Public participation and access to information must be ensured.³²⁶ Air pollution must be prevented³²⁷ and air quality must be monitored and reported on effectively.³²⁸ Discharges likely to have a negative impact on air quality must be mitigated,³²⁹ and finally these norms and standards should ensure compliance with South Africa's international agreements.³³⁰

From the above it is seen that the NF is meant to guide the implementation of NEMAQA to ensure that air quality is managed effectively. It contains measures meant to ensure efficient air quality management, monitoring and reporting, and to ensure that South Africa's international obligations are complied with. The exact extent and effectiveness of these measures, in particular with relation to climate change need to be assessed. Hence the NF will be considered further and referred to while the rest of NEMAQA is discussed.

5.2.2 Air quality management

Section 9 of NEMAQA provides for the determination of national ambient air quality and emission standards. The Minister must "identify substances or mixtures of

322 S 7(1)(a) of NEMAQA.

323 S 7(1)(b) of NEMAQA.

324 S 8(c) of NEMAQA.

325 S 8(a) of NEMAQA.

326 S 7(2)(a) and (b) of NEMAQA.

327 S 7(2)(c) of NEMAQA.

328 S 7(2)(f) and (g) of NEMAQA.

329 S 7(2)(d) of NEMAQA.

330 S 7(2)(h) of NEMAQA.

substances in ambient air which, through ambient concentrations, bioaccumulation, and deposition or in any other way, present a threat to health, well-being or the environment or which the Minister reasonably believes present such a threat."³³¹ After these substances have been identified the Minister must establish the permissible amount of these substances in the air,³³² and may set emission standards for the release of these substances by mobile sources³³³ or from point and non-point sources.³³⁴

A set of interim ambient air quality standards has been published by the Minister³³⁵ and a new set of ambient air quality standards is currently being developed.³³⁶ However these standards do not contain measures to mitigate climate change, as greenhouse gases have not been listed. This is understandable as South Africa has not committed itself to an emission reduction target on an international level. But, during the recent Climate Change Summit the development of a National Climate Change Response Policy was initiated.³³⁷ In the Initial Policy Framework document it is stated that:³³⁸

Climate change mitigation interventions should be informed by, and monitored and measured against a "peak, plateau and decline" emission trajectory where greenhouse gas emissions stop growing (start of plateau) in 2020-25 and begin declining in absolute terms (end of plateau) in 2030-35.

It accordingly appears as if South Africa is including mitigation measures in its longer term planning processes, but it has not started to govern the release of greenhouse

331 S 9(1)(a) of NEMAQA.

332 S 9(1)(b) of NEMAQA.

333 S 1 defines a mobile source as a single identifiable source of atmospheric emission which does not emanate from a fixed location. A point source means "a single identifiable source and fixed location of atmospheric emission, and includes smoke stacks and residential chimneys" and a non-point source means "a source of atmospheric emissions which cannot be identified as having emanated from a single identifiable source or fixed location, and includes veld, forest and open fires, mining activities, agricultural activities and stockpiles." Thus the minister has the authority to regulate all direct sources of air pollution by setting emission standards for each source.

334 S 9(1)(c) of NEMAQA.

335 GN 528 in GG 28899 of 9 June 2006. These standards prescribe ambient air quality standards for the following gases: Sulphur Dioxide (SO₂), Carbon Monoxide (CO) and Nitrogen Dioxide (NO₂).

336 GN 263 in GG 31987 of 13 March 2009. These standards prescribe standards for Sulphur Dioxide (SO₂), Carbon Monoxide (CO), Nitrogen Dioxide (NO₂), Particulate Matter, Ozone (O₃), Lead (Pb) and Benzene (C₆H₆).

337 See par 1 above.

338 DEAT *Towards an Effective South African Climate Change Response Policy* 4.

gases in a direct manner. Therefore local government will not be expected to govern the emission of greenhouse gases through the implementation of these standards yet. Whether this approach is acceptable by the international community and whether it meets the urgent need to mitigate climate change remains to be seen. South Africa is the 11th highest contributor of greenhouse gas emissions worldwide.³³⁹ Thus it is imperative that measures are taken to limit emissions as soon as possible.

Sections 10 and 11 make provision for the establishment of provincial and local air quality standards. Such standards may apply only if there are no national standards or if the provincial or local standards are stricter. Thus a province or municipality may still elect to govern the emissions of greenhouse gases by implementing its own set of emission control measures and standards. However it would be desirable that standards managing greenhouse gases are developed at a national level as such standards will bind the entire government, thereby ensuring that measures are implemented to mitigate climate change on a fair basis and equally throughout the country.

5.2.3 Listing and licensing of activities

The next important air quality governance mechanism is the listing and licensing of certain activities. The Minister must, or the MEC may:³⁴⁰

Publish a list of activities which result in atmospheric emissions and which the Minister or MEC reasonably believes have or may have a significant detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage

The list of activities identified by the Minister applies nationally, and the list by the MEC applies provincially. When an activity has been identified no person may conduct such an activity without a provisional atmospheric emission licence (hereafter a PAEL) or an atmospheric emission licence (hereafter an AEL).³⁴¹ The

339 DEAT *Towards an Effective South African Climate Change Response Policy* 12.

340 S 21(1)(a) of NEMAQA.

341 S 22 of NEMAQA.

list of activities and associated emission standards is currently under development and the final draft of the list was published for comment on 24 July 2009.³⁴²

Section 36 determines that metropolitan and district municipalities are charged with the implementation of the atmospheric emission licensing system, and these municipalities will serve as the licensing authorities in their area of jurisdiction. Thus any person who is conducting or is planning to conduct a listed activity must apply for a licence from the applicable local authority.³⁴³ When applying for a PAEL or AEL the provisions of section 24 of NEMA will also apply, meaning that an EIA will need to be conducted.

The licensing authority must consider the application and take all relevant factors into account, these factors include the applicable minimum standards for ambient air and point source emissions,³⁴⁴ the pollution that is being caused or is likely to be caused by the listed activity, and the impacts thereof on the environment.³⁴⁵ The authority must also consider the best practicable environmental options (hereafter BPEO) that could be taken to prevent, control, mitigate, or abate the pollution, and the BPEO to protect the environment from harm that may result from the pollution.³⁴⁶ The authority must also consider the submissions made by the applicant³⁴⁷ and submissions from organs of state, interested persons and the public.³⁴⁸ Before a licensing authority (a municipality) may issue a licence it must consider these factors. Thus, the applicant will need to conduct an EIA and a specialist Air Quality Impact Assessment to ensure that the authority has the information it needs to make the decision.³⁴⁹

342 GN 1001 in GG 32434 of 24 July 2009. The draft regulation identifies the sectors that conduct listed activities. They include combustion installations, the petroleum industry, carbonation and coal gasification processes, the metallurgical industry, the organic chemicals industry, the inorganic chemicals industry, waste, and the pulp and paper industries.

343 S 37 of NEMAQA.

344 S 39(a) of NEMAQA.

345 S 39 of NEMAQA. This includes health, social conditions, economic conditions, ambient air quality and cultural heritage impacts.

346 S 39(c)(i) and (ii) of NEMAQA.

347 S 39(g) of NEMAQA.

348 S 39(h) of NEMAQA.

349 NF 68.

The specialist Air Quality Impact Assessment must include a list of considerations. The impact of the activity on human health must be analysed and reported. The cumulative impact of the activity on the ambient air quality, and the relevant point source emission standards must be addressed in the assessment report. Finally the BPEO that will prevent, control, abate or mitigate pollution must be implemented.³⁵⁰

After all of the relevant considerations have been taken into account the licensing authority may grant or deny an application. The licensing authority's decision must be consistent with NEMAQA and other national and provincial legislation and policies, the EIA procedure in terms of NEMA, the national environmental management principles in NEMA, the objectives of the Air Quality Management Plan³⁵¹ (hereafter AQMP) of the area and with the ambient air quality and emission standards in terms of NEMAQA.³⁵²

Section 43 determines that an AEL and a PAEL must contain certain information³⁵³ and that it must specify certain requirements that bind the licence holder.³⁵⁴ Additionally NEMAQA requires that an AQMP must seek to implement South Africa's obligations with regard to its international agreements, and that an AEL must specify greenhouse gas emission measurements and reporting requirements. Thus the applicants' specialist Air Quality Impact Assessment will also have to include information on the greenhouse gas emissions of the proposed activity.³⁵⁵

These provisions have two implications for climate change. Firstly, when processing a licence application the local licensing authority must consider the emissions of greenhouse gases, together with all other relevant factors. Thus local authorities will be able to stop activities that will adversely affect the climate by denying a licence. Secondly, an AEL or PAEL must specify how licensed activities greenhouse gas

350 NF 69.

351 An AQMP is a regional planning document that is meant to guide the air quality management of a region. It will be discussed more fully later in par 5.2.6 below.

352 S 40 of NEMAQA.

353 Information regarding the nature of the activity, premises, person and period for which the licence is issued and when it will be reviewed, the name of the licensing authority and the maximum amount of pollutants that may be released in normal and normal start-up, maintenance and shut-down conditions.

354 These include operational requirements, point source and ambient emission measurement and reporting requirements, and any other measures necessary to protect air quality.

355 NF 70.

emissions must be monitored and reported on. This will allow local authorities to gather data on greenhouse gas emissions, as required by international law.³⁵⁶

5.2.4 Controlled fuels and emitters

NEMAQA makes provision for controlling identified fuels and emitters. These provisions are important as they allow the Minister to manage sources of greenhouse gases through implementing certain standards.

Section 23 enables the Minister or MEC to declare an appliance or activity to be a controlled emitter if such an appliance or emitter results in atmospheric emissions that present a threat to health or the environment.³⁵⁷ After the declaration that the appliance or emitter is a controlled emitter, emission standards for that emitter must be set,³⁵⁸ and no person may manufacture, sell, use or conduct such a declared activity if it does not meet the standards that were set.³⁵⁹ Furthermore section 26 allows the Minister or MEC to declare fuels that result in atmospheric emissions that presents a threat to health or the environment to be controlled fuels. After a controlled fuel has been declared, standards regulating the fuel are set, and the fuel may not be used, manufactured or sold if it does not comply with the prescribed standards.³⁶⁰

The NF lays down guidelines for the identification and prioritising of areas of concern.³⁶¹ These guidelines apply to listing and licensing³⁶² as well as to controlled emitters³⁶³ and fuels.³⁶⁴ When deciding whether or not a substance should be identified, international conventions must be kept in mind.³⁶⁵ This means that South Africa's international duties such as the mitigation of climate change must be considered in the identification and standard-setting process. The inclusion of these

³⁵⁶ See par 4.2 above.

³⁵⁷ S 23(1) of NEMAQA.

³⁵⁸ S 24 of NEMAQA.

³⁵⁹ S 25 of NEMAQA.

³⁶⁰ S 27 of NEMAQA.

³⁶¹ NF 45.

³⁶² S 21 and 22 of NEMAQA.

³⁶³ S 23(1) of NEMAQA.

³⁶⁴ S 26(2)(c) of NEMAQA.

³⁶⁵ NF 45.

provisions enables and compels the Minister to mitigate climate change by controlling emitters and fuels that produce greenhouse gases.

Local governments' role with regard to controlled fuels and emitters relates to compliance monitoring. The NF determines that metropolitan and district municipalities must monitor compliance with these standards.³⁶⁶ The effective implementation of these standards will depend on the compliance monitoring performed by local authorities. To date no fuels or emitters have been declared as controlled fuels or emitters, but the NF states that greenhouse gases may be listed as pollutants of concern.³⁶⁷ Thus, local governments' duties in this regard will come into effect only when the necessary standards are determined.

5.2.5 National monitoring and information management standards

The Act makes provision for national monitoring and information standards with regard to the monitoring of air quality and emissions.³⁶⁸ It also makes provision for the collection and management of data necessary to ensure compliance with South Africa's international obligations.³⁶⁹ Furthermore, the Minister must prescribe the manner of measuring and reporting air quality measurements.³⁷⁰ This will enable the Minister to make provision for the monitoring of greenhouse gas emissions and the assembly of data with regards to climate change, as required by the UNFCCC.³⁷¹ The reference to South Africa's international obligations is of special importance, as section 12 of the UNFCCC describes the way in which these reports should be compiled, and if these obligations are kept in mind the reports will be in order.

The NF established the South African Air Quality Information System (hereafter referred to as the SAAQIS).³⁷² The SAAQIS will provide information on South African air quality in the broad sense, as well as information on how to produce and

366 NF 28.

367 NF 46.

368 S 8(a) and (b) of NEMAQA.

369 S 8(c)(v) of NEMAQA.

370 S 12 of NEMAQA.

371 A 10(d) of the *Kyoto Protocol*.

372 NF 34.

present ambient air quality data,³⁷³ while it sets norms and standards with regard to air quality monitoring.³⁷⁴ The SAAQIS is meant to provide the basis for South Africa's next National Communication, which is due during 2011,³⁷⁵ and plans to implement a national greenhouse gas inventory by the end of the year 2009.³⁷⁶ The SAAQIS can meet South Africa's obligations with regard to reporting in terms of article 4 of the UNFCCC. It also goes a long way towards facilitating public access to information as required in article 10(e) of the *Kyoto Protocol*.

In terms of the NF, metropolitan and district municipalities have the principle responsibility to monitor ambient air quality and emissions from point, non-point and mobile sources.³⁷⁷ These authorities should also specify greenhouse gas emission and reporting requirements in PAELs and AELs. Thus local authorities are responsible for implementing greenhouse gas measurement interventions as informed by the SAAQIS. Local authorities are hence responsible for collecting data on greenhouse gas emissions, thereby enabling the SAAQIS to compile the reports necessary to give effect to South Africa's international reporting obligations.

5.2.6 Air Quality Management Planning

NEMAQA determines that every national department or province responsible for preparing an environmental implementation plan or management plan must include an AQMP in such a plan.³⁷⁸ But more importantly it states that "each municipality must include in its integrated development plan ... an air quality management plan."³⁷⁹ Such an AQMP must seek to achieve certain objectives.³⁸⁰

373 NF 34.

374 NF 36.

375 NF 44.

376 NF 44.

377 NF 23.

378 S 15(1) of NEMAQA.

379 S 15(2) of NEMAQA. IDPs were discussed fully at par 3.6 above.

380 S 16(1)(a) of NEMAQA. Also see Strydom and King (eds) *Environmental Management* 590.

The AQMP must give effect to the provisions dealing with co-operative government³⁸¹ contained in chapter 3 of NEMA and arguably also the provisions of the *Intergovernmental Relations Framework Act*.³⁸² The AQMP should include measures to improve air quality,³⁸³ and should identify and reduce the negative impacts of poor air quality on human health and the environment.³⁸⁴

The AQMP must also address the effects of emissions of fossil fuels in residential applications³⁸⁵ and of emissions emanating from industrial sources.³⁸⁶ More importantly the AQMP must seek "to implement the Republic's obligations in respect of its international agreements."³⁸⁷ When read together with the other duties it seems as if local authorities should consider greenhouse gas emissions and mitigation, as well as adaptation, in their planning. This conclusion can be drawn when the provisions requiring an AQMP to address emissions from industries and fossil fuels are assessed in the light of South Africa's international obligation to mitigate and adapt to climate change.³⁸⁸

Finally, the AQMP must give effect to best practice in air quality management.³⁸⁹ This means that measures taken to achieve any of the above objectives must be guided by the best practices for air quality management. It is proposed that effective co-operative governance can be helpful in ensuring compliance with this requirement. Local authorities should co-operate by *inter alia* exchanging information on their approaches to air quality management. Such information exchange can allow authorities to learn from one another, and could potentially enable them to overcome challenges they would not be able to overcome otherwise. Likewise national and provincial government can support each other and local authorities by developing programmes and guidelines that inform and guide air quality management. Ideally such programmes and guidelines should contain

381 Co-operative government is important as a successful response to climate change must involve various spheres of government. For further reading on co-operative government see Du Plessis *SAPL*.

382 *Intergovernmental Relations Framework Act* 13 of 2005.

383 S 16(1)(a)(ii) of NEMAQA.

384 S 16(1)(a)(iii) of NEMAQA.

385 S 16(1)(a)(iv) of NEMAQA.

386 S 16(1)(a)(v) of NEMAQA.

387 S 16(1)(a)(viii) of NEMAQA.

388 Duties as discussed at par 4.2 above.

389 S 16(1)(a)(viii) of NEMAQA.

specific reference to climate change, and the interventions that must be implemented and monitored in response thereto.

It should be noted that the AQMP must also describe how the relevant organ of state will give effect to the plan.³⁹⁰ The NF states that an AQMP must be a logical description of the interventions and required resources aimed at implementing a strategy to achieve a specific objective.³⁹¹ Thus it is clear that local government will need to compile an AQMP with the aim of giving effect to the provisions of NEMAQA and to the Republic's international obligations. This document must contain a practical description of the measures that will be implemented to achieve the prescribed objectives.

The DWEA published an implementation manual for air quality management planning that gives guidance on the development of an AQMP.³⁹² The manual distinguishes between a detailed AQMP and a basic AQMP and describes the content of each. If the air quality in the area is acceptable a basic AQMP must be formulated, if the air quality is potentially poor a detailed AQMP must be formulated but certain exclusions will apply, and if the air quality is poor a detailed AQMP must be formulated with no exclusions.³⁹³ Thus metropolitan, district and local municipalities will have to compile an AQMP that is appropriate for the current state of air quality in their areas.³⁹⁴ This distinction is important as it will allow municipalities with good air quality, and thus relatively low emissions of greenhouse gases, to focus their attention on more urgent priorities. Likewise, municipalities with poor air quality and higher emissions are directed to implement more thorough and detailed strategies to address their air quality.

The development of an AQMP is divided into six steps.³⁹⁵ The first stage of the development process is the identification of goals and targets for the AQMP. These goals should focus on meeting standards and regulations, the identification and

390 S 16(1)(a)(viii) of NEMAQA.

391 NF 63.

392 *Draft Implementation Manual for AQMP*. Available at <http://aqmp-za.nilu.no/>.

393 *Draft Implementation Manual for AQMP* ii.

394 Table 24 of the NF contains a list of 28 municipalities with poor and potentially poor air quality. These municipalities must compile a full AQMP. See NF 47.

395 *Draft Implementation Manual for AQMP* 14.

mitigation of pollutants of concern, regional issues, global issues such as greenhouse gases, and training and capacity building. Additionally the provisions of NEMAQA and the NF must also be kept in mind during the goal-setting process.³⁹⁶

The goal-setting process is followed by a baseline assessment of the relevant area's air quality, and must consider air quality data, sources of air pollution, and area data. The baseline assessment must include a description of the area to which the AQMP will apply, the area's meteorology and climate, the population of the area, the current state of air quality in the area, and pollutants that exceed the prescribed air quality standards. A description of the existing air quality measurement programmes must be included, and sources and pollutants of concern must be identified. The baseline assessment should also indicate the most important air quality priorities, and should evaluate the management tools available to address the problems.³⁹⁷

During the next stage of the process an Air Quality Management System (hereafter an AQMS) must be developed. The AQMS must establish an air monitoring system that should be used to obtain the data that is necessary to achieve the goals and objectives of the AQMP.³⁹⁸ The AQMS must also ensure that an emission inventory is kept. This means that the sources and locations of the sources of air pollution must be identified, and that the amount of emissions and the variations thereof must be determined.³⁹⁹ The AQMS must apply a system of atmospheric dispersion modelling and these models need to establish the relationship between emissions and air quality. Thus the AQMS is meant to inform the intervention strategies that will be undertaken to mitigate air pollution in the area.⁴⁰⁰ Therefore the AQMS must contain practical interventions necessary to measure emissions, including emissions of greenhouse gases.

A gap analysis must also be conducted to determine whether or not past and current measures are sufficient to address air quality challenges. Thus, gaps in the current AQMS must be identified, such as an incomplete emissions inventory or problems

396 *Draft Implementation Manual for AQMP* 14.

397 *Draft Implementation Manual for AQMP* 15-21.

398 *Draft Implementation Manual for AQMP* 22.

399 *Draft Implementation Manual for AQMP* 23.

400 *Draft Implementation Manual for AQMP* 24.

relating to the integration of climate change issues like mitigation into the management system. After the gap analysis has been completed a problem analysis should be conducted. The identified gaps will be identified as problems, along with any other previously known problems, and these problems must be analysed and prioritised to ensure that they are addressed.⁴⁰¹

During the fourth stage of the process the results of the problem and gap analysis should be used to develop a set of intervention strategies aimed at addressing the problems.⁴⁰² The fifth stage of the process is the development of action plans with which the identified interventions will be implemented. These plans should include control strategies and strategies for the enforcement of legislation and regulations, and should also indicate a time frame wherein the interventions must take place.⁴⁰³

After all of the above steps have been taken the completed draft AQMP must be evaluated. This is done by submitting the draft AQMP to all of the key stakeholders⁴⁰⁴ for review/comment, during which, *inter alia*, the AQMP's planned interventions are assessed.⁴⁰⁵ This provision is important. It ensures that an AQMP is reviewed to guarantee that the measures included therein will meet its objectives, and that all actors are involved in the AQMP's development, as required by international law.⁴⁰⁶

The AQMP is accordingly meant to guide the measures local government will implement with regard to air quality management. These measures should *inter alia* ensure compliance with South Africa's international obligations. It is positive to note that the evaluation checklist as contained in the implementation manual contains references to climate change-related measures, thus ensuring that climate change is considered as part of an AQMP.⁴⁰⁷ The AQMP and its associated development processes are praiseworthy as they are detailed, and are aimed at achieving

401 *Draft Implementation Manual for AQMP* 25.

402 *Draft Implementation Manual for AQMP* 27.

403 *Draft Implementation Manual for AQMP* 30.

404 Stakeholders include, amongst other, the national and provincial departments of the DWEA and the departments of health in the two government spheres.

405 *Draft Implementation Manual for AQMP* 32.

406 The UNFCCC and *Kyoto Protocol* require stakeholder involvement in any measure meant to address climate change. See par 4.1 above.

407 *Draft Implementation Manual for AQMP* 62.

concrete objectives. One of these objectives is compliance with South Africa's international objectives. It is therefore to be expected that an AQMP will set out concrete interventions that address climate change. It is proposed that this approach should be followed in the other sectors affected by climate change as well such as water management, planning and energy resources management. Such an approach could ensure that climate change responses are integrated and aligned with all other relevant considerations that are applicable to a specific sector. Such a strategy could be even more effective if each sector plan is integrated into a municipality's IDP. This could ultimately ensure that the climate change responses integrated into a sector plan are aligned and co-ordinated throughout a municipality.

5.3 Conclusion

In paragraph 4 it was shown that the international legal framework on climate change contains several duties that may arguably best be managed in the local government sphere. The paragraph analysed the South African legal framework with the aim of determining to what extent it facilitates the role of local government in responding to climate change in the air quality management sector.

It was also shown that the NF delegates several responsibilities to the local government sphere. Municipalities must implement the AEL system and must include climate change-related considerations into the licensing authorisation process, as well as into the conditions of a specific licence. EIA and air quality impact assessments require public participation, thus ensuring that the requirements in the *Kyoto Protocol* and the UNFCCC are met in this instance.⁴⁰⁸

Municipalities must also measure and monitor ambient air quality and the emissions from point, non-point, and mobile sources, and as they have to take South Africa's international duties into account, they should also measure the emissions of greenhouse gases. Finally, local government must compile an AQMS which could guide the implementation of NEMAQA on a local level, also with a view to address matters relevant to climate change.

408 See par 4.1.1 and 4.1.2 above.

Thus it is clear that local government has a very important role to play in air quality management, especially with regard to monitoring and information management. This is important as all climate change interventions must be informed by high-quality scientific data, and without such data an effective climate change response will be impossible.

The evaluation conducted in this section showed that South African law does indeed explicitly and implicitly facilitate, at least in part, the role of local government in addressing the phenomenon of climate change, especially in the context of air quality.

6 Conclusions and recommendations

This study commenced with an analysis of the climate change phenomenon.⁴⁰⁹ It showed that climate change is caused by human activities, and that the effects of the phenomenon will have and actually already show far reaching consequences.⁴¹⁰ The scientific community has subsequently identified the need to respond to climate change by implementing measures to mitigate and adapt to climate change.⁴¹¹

The legal framework that governs South Africa's local sphere of government generally was analysed to determine its potential role in the country's climate change response.⁴¹² It was shown that local government has various objectives, duties and functions that will be affected by climate change, and that local authorities also have the necessary executive and legislative powers that should enable them to achieve their constitutional objectives; including those related to peoples' well-being.⁴¹³ Integrated development planning was also discussed, and it was shown that this planning tool could be used to co-ordinate a local authority's response to climate change.⁴¹⁴ It was also indicated that local authorities face certain challenges that inhibit their ability to respond to climate change. These include, but are not limited to, a clear legal and political mandate to respond to climate change, uncertainties

409 See par 2 above.

410 See para 2.1 and 2.2 above.

411 See par 2.2 above.

412 See par 3 above.

413 See para 3.2, 3.3 and 3.4 above.

414 See par 3.6 above.

with relation to ownership of the challenges presented by climate change, and uncertainties about the extent and nature of the interventions that should be implemented in response to climate change.⁴¹⁵

The study next assessed the international legal framework in order to identify South Africa's duties in terms of international law.⁴¹⁶ These duties were considered together with the functional areas which are the responsibilities of local governments in order to identify the type of measures that local authorities should implement in response to climate change, generally. It was found that local authorities have several obligations that includes measures to; mitigate and adapt to climate change, as well as to gather information on climate change and air quality.⁴¹⁷

South Africa's environmental framework legislation was considered in order to determine whether or not it contained adequate measures to facilitate and guide a local government's general response to climate change.⁴¹⁸ It was found that NEMA contains several environmental management principles that provide generic guidance on decisions that will have an impact on the environment. The principle of sustainable development and the precautionary principle are expected to be very important due to the nature of the climate change phenomena.⁴¹⁹

These principles also have various links with the guiding principles contained in the UNFCCC, and consequently it was argued that the implementation of NEMA's principles can guide South Africa's response to climate change generally. NEMA also contains measures for integrated environmental management, which should be implemented in order to identify, oppose and find alternatives to developments that will adversely affect the climate system.⁴²⁰

Finally, NEMAQA was considered to illustrate the role of local government in governing air quality as a prominent facet in climate change management.⁴²¹ It was

415 See par 3.6 above.

416 See par 4.1 above.

417 See par 4.2 above.

418 See par 5 above.

419 See par 5.1 above.

420 See par 5.1 above.

421 See par 5.2 above.

shown that the provisions of NEMAQA allocate several responsibilities that have climate change implications to local government. Local authorities must *inter alia* monitor and manage ambient air quality, and must monitor standards in dealing with listed fuels and emitters.⁴²² More importantly, local governments are responsible for licensing and for the issuing of AELs and PAELs. The licensing process has several implications for climate change. Firstly, it can be used to oppose activities that will unduly affect the climate system. Secondly, local authorities should include greenhouse gas emission and reporting requirements in a licence.⁴²³ These duties were set out and explained in the NF, and it is suggested that all sector-specific measures aimed at addressing climate change should be approached in the same way.⁴²⁴ This suggestion will be amplified below. Finally, municipalities are responsible for the development of AQMPs.⁴²⁵ These plans should serve as practical documents that ensure that municipalities' objectives in relation to air quality management and climate change are met.

The following strong points in the legal framework that govern local authorities in their response to climate change were found.

- The legal framework governing local government allocates local decision-makers with executive and legislative powers. These powers can be used to implement measures in response to climate change;
- Local government has clearly defined functional areas that can provide local authorities with guidance on their expected role in South Africa's' climate change response in general;
- The IDP can be used as an effective tool with which local government can facilitate its response to climate change;
- In general, local authorities are positioned in a manner that enables them to implement some of the measures that should be taken by South Africa in response to climate change. These include; greenhouse gas information gathering, the mitigation of climate change, through transport management for example, and adaptation;

422 See para 5.2.3 and 5.2.4 above.

423 See par 5.2.3 above.

424 See par 5.2.1 above.

425 See par 5.2.6 above.

- The environmental management principles in NEMA, such as the precautionary principle, among others, can provide guidance to local decision makers in their approach to climate change in general; and
- The air quality management planning provisions contained in NEMAQA establish a clear legal mandate for local government in relation to air quality management, also with a view to climate change.

The following weak points were found.

- There is a general need for a clearer legal mandate with measurable targets and objectives that require local authorities to implement measures in response to climate change;
- Lack of political will in local authorities to address climate change;
- Local authorities lack clarity on the extent and nature of the measures they should implement in response to climate change;
- Not all municipalities have the capacity (human and financial) to respond to climate change due to financial constraints and a lack of expertise, and a general lack of knowledge on their vulnerabilities to the changes brought along by the phenomena;
- In the climate change response measures that have been implemented up to now the focus has been on mitigation. The legal framework should make it clear that measures to adapt to climate change are given the same priority as mitigation. The difference between the two should also be more clearly acknowledged in law and policy;
- Lack of strong enforcement measures to drive climate change mitigation. Air quality management tools such as controlled fuels and emitters have not been implemented with the aim of mitigating climate change as of yet.

In the light of the above findings it is recommended that the following actions should be taken:

- The mandate of local, provincial and national government in relation to climate change should be set out and clarified;

- The division of climate change related responsibilities should be done with South Africa's international obligations in mind;
- Priority areas for mitigation should be identified based on the mitigation potential and cost effectiveness of a proposed intervention;
- Adaptive measures should be prioritised in accordance with the specific vulnerabilities of an area. In the identification of these priority areas local action will be essential;
- After these measures have been prioritised the duty to implement these interventions should be assigned. When the role of the local sphere of government is determined the functional areas of local government as set out in Schedules 4(B) and 5(B) of the *Constitution* should be considered. It is suggested that local authorities are ideally situated to manage their areas of competency as awarded to them in terms of the *Constitution*;
- After the mandates of local authorities have been clarified, sector-specific plans and programmes should be developed in co-operation with national, provincial and local government;
- These plans must be required to be integrated into municipalities' IDPs;
- Plans and programmes should as far as possible set out the nature of the required interventions and must be accompanied with measurable targets. It is suggested that the approach followed in NEMAQA should be replicated in each of the sectors in which climate change response measures will need to be implemented. These sectors include, but are not limited to the water, waste, electricity, biodiversity, emergency response and planning-sectors. Thus, a national framework that guides the development and implementation of climate change-related measures, like the NF,⁴²⁶ should be developed for every sector and local government in the specific; and
- Sector-specific frameworks should contain guidelines for the development of a local authority's response strategy. Such guidelines can be similar in nature to the implementation guidelines developed for a local authority's AQMP.⁴²⁷ It is argued that such an approach will ensure that all climate change interventions by a local government are specific and detailed enough to

426 See par 5.2.1

427 See 5.2.6 above.

ensure that they are effective, while the incorporation of such a sector-specific plan into a local government's IDP should ensure that interventions are integrated and support one another.

6.1 Closing

This study has shown that scientific evidence confirms that climate change is a real and serious challenge that requires urgent attention. It was shown that local authorities will need to take part in an effective response to climate change, and they already have a role with regard to air quality management, in the specific. Some more clarity may be required by means of future research in terms of local government and other facets of climate change. The measures currently expected on the part of South Africa's local authorities should be implemented without delay in order for the country (at least in part) to meet its international law duties but also because of the prominent developmental role of local authorities and the significant human impacts that climate change pose.

Addendum

Table 1: Examples of vulnerable sectors and adaptive measures⁴²⁸

Vulnerable sectors	Reactive adaptation	Anticipatory adaptation
Water Resources	- Protection of groundwater resources. - Improved management and maintenance of existing water supply systems. - Protection of water catchment areas. - Improved water supply. - Groundwater and rainwater harvesting and desalination.	- Better use of recycled water. - Conservation of water catchment areas. - Improved system of water management. - Water policy reform including pricing and irrigation policies. - Development of flood controls and drought monitoring.
Agriculture and food Security	- Erosion control. - Dam construction for irrigation. - Changes in fertilizer use and application. - Introduction of new crops. - Soil fertility maintenance. - Changes in planting and harvesting times. - Switch to different cultivars. - Educational and outreach programmes on conservation and management of soil and water.	- Development of tolerant and resistant crops. (to drought, salt, insect/pests) - Research and development. - Soil-water management. - Diversification and intensification of food and plantation crops. - Policy measures, tax incentives/subsidies, free market. - Development of early warning systems.
Human health	- Public health management reform. - Improved housing and living conditions. - Improved emergency response.	- Development of early warning systems. - Better and/or improved disease/ vector surveillance and monitoring. - Improvement of environmental quality. - Changes in urban and housing design.

⁴²⁸ UNFCCC *Impacts, Vulnerabilities and Adaptation in Developing Countries* 31.

Terrestrial ecosystems	Improvement of management systems including control of deforestation, reforestation and afforestation. Promoting agroforestry to improve forest goods and services. Development/improvement of national forest fire management plans. Improvement of carbon storage in forests.	Creation of parks/reserves, protected areas and biodiversity corridors. Identification/development of species resistant to climate change. Better assessment of the vulnerability of ecosystems. Monitoring of species. Development and maintenance of seed banks. Including socio-economic factors in management policy.
Coastal zones and marine Ecosystems	Protection of economic infrastructure. Public awareness to enhance protection of coastal and marine ecosystems. Building sea walls and beach reinforcement. Protection and conservation of coral reefs, mangroves, sea grass and littoral vegetation.	Integrated coastal zone management. Better coastal planning and zoning. Development of legislation for coastal protection. Research and monitoring of coasts and coastal ecosystems.

Table 2: Examples of mitigation techniques and strategies⁴²⁹

	Available Strategies	Future strategies
Transport	Hybrid and more fuel-efficient vehicles. Cleaner diesel engines. Use of biofuels. Shifts from road to rail and public transport. Cycling and walking. Land use and transport planning.	Second generation biofuels. Higher-efficiency aircraft. Advanced electric and hybrid vehicles with more powerful and reliable batteries.
Buildings	Use of daylight. More efficient appliances. Improved insulation. Passive and active solar design. Alternative refrigeration fluids. Recovery and recycling of	Integrated design of commercial buildings. Including technologies such as intelligent meters that provide feedback and control. Solar photovoltaics integrated in buildings.

429 UNEP *Climate in Peril* 43.

	fluorinated gases. Efficient lighting.	
Industry	More efficient electrical equipment. Heat and power recovery. Material recycling and substitution. Control of non-CO₂ gas emissions. A wide array of process-specific manufacture.	Advanced energy efficiency. Carbon Capture and Storage for cement, ammonia and iron manufacture. Inert electrodes for aluminium.
Agriculture	Improved crop and pasture management to increase soil carbon storage. Restoration of cultivated peaty soils and degraded land. Improved rice-growing techniques and livestock and manure management to reduce methane emissions. Improved nitrogen fertilizer.	Improved crop yields.
Forestry	Afforestation and reforestation. Reducing deforestation. Improved management of forest resources. Use of wood for bio-energy to replace fossil fuels	Tree species improvement to increase biomass productivity and carbon sequestration. Improved remote sensing technology to analyse the carbon sequestration potential of vegetation and soils, and map changes in land-use.
Waste	Recovering methane from landfills. Waste incineration with energy recovery. Composting organic waste controlled wastewater treatment. Recycling and minimising waste.	Biocovers and biofilters to optimize methane oxidization (such technologies improve methane combustion by minimising carbon emissions).

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