ENVIRONMENTAL PLANNING & CLIMATE PROTECTION DEPARTMENT

ETHEKWINI MUNICIPALITY

ENERGY OFFICE

eThekwini. The sustainable energy hub.

BIODIVERSITY | CLIMATE | PEOPLE

Title: Durban Climate Change Strategy
Waste and Pollution Theme Report

Date: 28/11/2013

Report prepared by: Amanda Botes and Margaret McKenzie, Urban Earth
Reviewed by Theo Fischer
Approved by: Sean O'Donoghue and Derek Morgan

Acknowledgements

The Durban Climate Change Strategy (DCCS) project is funded and lead by the Environmental Planning and Climate Protection Department (EPCPD) and the Energy Office (EO) of eThekwini Municipality.

The EPCPD and EO have commissioned Urban Earth in association with FutureWorks! to assist in the implementation of the project.

Contents

Introduction

The Environmental Planning and Climate Protection Department (EPCPD) and the Energy Office (EO) of eThekwini Municipality have commissioned Urban Earth, in association with FutureWorks!, to develop a city-wide climate change adaptation and mitigation strategy for Durban[1] through an inclusive and participatory process entitled the Durban Climate Change Strategy (DCCS).

During the initial consultation phases of the project seven key themes were identified for the strategy:

1. Biodiversity
2. Health
3. Food Security
4. Water
5. Sustainable Energy
6. Transport
7. Waste and Pollution

Separate public workshops were hosted for each theme to secure stakeholder input on the aims and strategies for each of the themes. In addition seven technical experts were procured by EPCPD and EO to provide expert technical advice on each of themes.

Section one and two of this report provides a summary of the waste and pollution and climate change context for Durban based on a preliminary report from technical expert Theo Fischer from EScience Associates. The introductory technical report is available for download on the DCCS website. Sections three and four, which outline a vision, aim and strategies for the waste and pollution theme, are based on the input provided by stakeholders at the waste and pollution theme working group meeting held on 29 October 2013 and recommendations by technical expert Theo Fischer. The minutes of the working group meeting can be found in Appendix One of this document.

Interested stakeholders are invited to submit online comments on the report. Comments will be presented at a follow up waste and pollution theme meeting for stakeholders that will be held in 2014. Following that meeting amendments will be made to the theme report. The waste and pollution theme report will then be combined with the reports from other themes to form a draft climate change strategy document that will also be distributed for comment.

[1]Including the eThekwini Municipal Area.

Section One: Current Status of Waste and Pollution

Large volumes of solid waste are generated in Durban by industry, commercial and residential sectors, the majority of which is disposed of in landfills with some being recovered. There are three general waste disposal sites in Durban, namely Mariannhill, Bisasar and Buffelsdraai, the latter being the largest waste disposal site in the city. These are all operated by Durban Solid Waste (DSW). According to the South African Waste Information Centre (SAWIC), these three operational sites service approximately 1.5 million tonnes of commercial and domestic waste per annum. However, this is considered to be an undercount (Fischer& Sanchezm, 2013). In addition, numerous other industrial waste disposal sites are operated by industry. In many informal settlements, an estimated 25% of waste is collected and reaches the formal waste collection system. Of the waste which is landfilled, about 90% is general solid waste, with liquid and hazardous waste making up the balance.

With regards to air pollution, industrial air pollution generally and especially the sulphur dioxide (SO_2) concentrations are a priority concern in the South Durban area, where oil refineries, paper mills, water treatment plants and other activities take place. This industrial hub, although responsible for the economic development of the city, is the cause of excessive and harmful air emissions. Industrial emissions, although the highest, are not the only source of air pollution in the Durban, household fuel combustion for heating and cooking, agricultural practices (specifically sugar cane burning) and transport also add significantly to the impact of air quality in the Durban.

Waste management and climate change

According to a report by the United Nations Environment Programme (UNEP, 2010), the waste management sector contributes minimally to global greenhouse gas (GHG) emissions, at only 3-5% of total global GHG emissions estimated for the 2005 year from waste treatment and disposal. Similarly, it is estimated that of Durban's total greenhouse gas emissions for the 2011 year (27,649,400 tCO_2e), 1% were from methane related sources (eThekwini Municipality, 2013) which include emissions from solid waste and waste water facilities (Figure 1). Whilst the greenhouse gas emissions from eThekwini Municipality's landfills are known, there is little information on other emissions related to waste, such as emissions resulting from the burning of waste, emissions associated with transporting waste, and emissions resulting from sludge that is discharged to the sea via marine outfall.

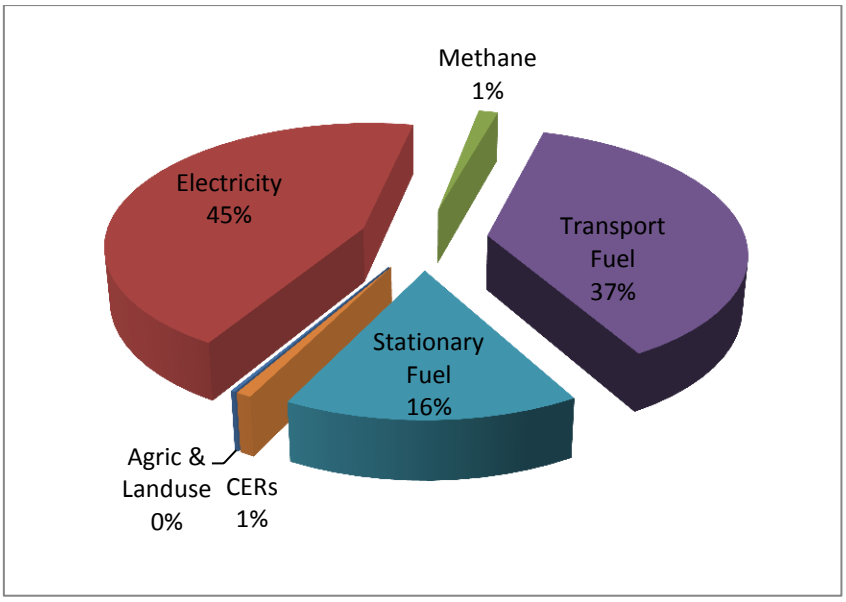

Figure 1: Durban's Total Carbon Emissions by Source for the 2011 year (eThekwini Municipality, 2013)

Even though the emissions from the waste sector are minimal, there is the potential for the waste sector to contribute to the saving of GHG emissions on a large scale through the prevention and reuse of waste, as these strategies impact on emissions reductions in other sectors in the supply chain (UNEP, 2010). A reduction in the production of waste, and the reuse and recycling of waste, results in less waste being transported to landfill, and a reduction in emissions associated with transport, as well as less waste ending up at landfill sites, where methane is produced. A reduction in the production of waste also results in a reduction in GHG emissions associated with extraction and manufacturing processes, as reduced raw materials are extracted, and less processing is required. It must be noted in some instances however more GHG's are emitted to separate and recover waste than is emitted by utilising virgin raw materials.

Globally there is a general consensus that the climate-related benefits of waste prevention and recycling are significantly greater than the benefits of waste treatment technologies, including energy recovery technologies. The "waste hierarchy" concept where different waste management strategies are ordered according to their impact is often mentioned in strategies worldwide, however, waste prevention, at the top of the waste hierarchy, receives the least amount of attention in terms of resource allocation (UNEP, 2010). Although the ultimate goal for sustainable development is to waste nothing (no wastage of matter/energy) within the system through the waste hierarchy, this goal is unachievable as some matter and/ or energy is always lost into surrounding systems (see Roper 2012 and McRobert 1992). In essence the aim remains however to reduce leakage of waste in the defined system as much as possible.

Realistically this can only be achieved through cluster industries, where some of the "waste" output of one industry is used as part of the input for another nearby industry, otherwise the energy required to transport waste material will exceed the clustering will further allow sharing labour and infrastructure and will further work to further lower the total entropy of

the cluster. Clustering of industries should not be confused with "cluster industries" which refers to industries of the same type being clustered, such as electronics industries (sharing common human sources and production techniques). In order to achieve waste-reducing clustering, such complexes will involve quite different types of industries in a symbiotic relationship (Pauli 2000 and Roper 2012). This has also been referred to as the eco-industrial park concept (an outgrowth of industrial ecology principles in which industrial activities are interconnected with one another and their supporting ecological systems).

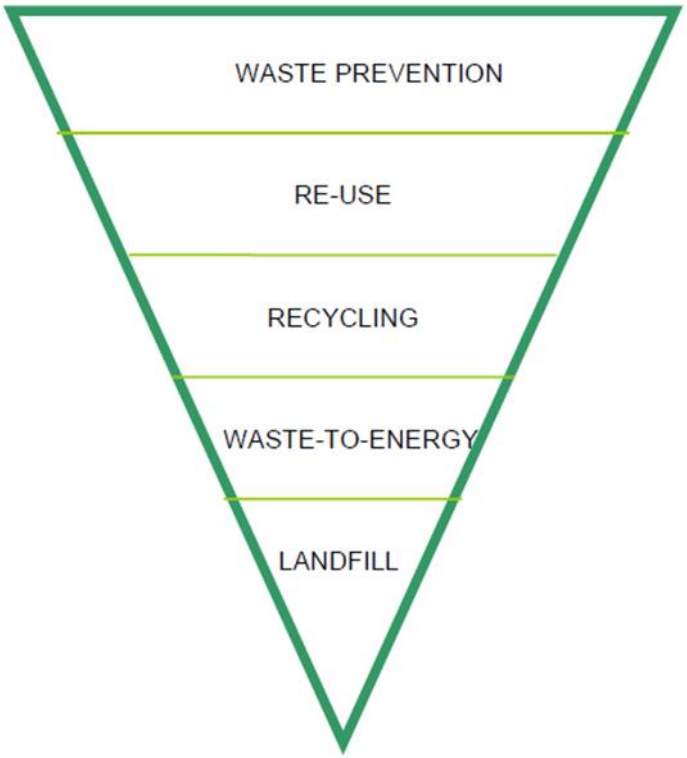

Figure 2: The waste hierarchy (UNEP, 2010)

There are a multitude of formal and informal job opportunities in the waste sector, especially in the re-use and recycling fields. In developing cities, like Durban, informal waste collectors and recyclers play a valuable role in reducing waste to landfill by recovering and redirecting waste into recycling streams and subsequently assisting with GHG savings (UNEP, 2010). Through reducing wastage by recovery there is opportunity not only to increase productivity, but also employment and this is again best achieved through industrial ecology principles in which industrial activities are interconnected with one another and their supporting ecological systems. Through clustering both a rise in raw material productivity and a rise in employment may be achieved. Broadly defined, clustering in an eco-industrial park (EIP) is best described as a community of businesses that cooperate with each other and with the local community to efficiently share resources, leading to increased employment and economic gains, improved environmental quality (for more details refer to PCSD 1996).

Air pollution and climate change

Another area of concern in Durban is the significant emissions of air pollutants (so called criteria and hazardous air pollutants) as well as greenhouse gasses into the atmosphere by the industrial sector, household fuel burning, transport, and biomass burning (wild veld fires/agricultural burning), which cause health impacts and contribute towards global warming.

Significant emissions of dangerous pollutants are released from industry, transport and biomass burning, as well as from household fuel burning. A summary of sources and their respective emissions to air of criteria pollutants and greenhouse gases is shown in Table 1 and Figure 4 for SO_2.

Table 1: Preliminary Estimated emissions to air from various sources in Durban

Source	PM_{10}	SO2	CO	NOX	CO_2	N2O	CH4	CO_2 eq	VOCs	PCDDs/Fs	Source
	(tons/year)									(gTEQ/year)	
Industry		22 181									Durban AQMP,2005.
Households fuel burning	1 555	171	12 319	514	191 196	10	1 345		2 174		ESA,2013
Biomass burning (veld fires)	130	8	1 473	31	24 023	3				87	ESA,2013
Wastewater									35		ESA based on EGHEI,2013
Power Generation (indirect)	3 757(a)	93 712(a)		48 393(a)				12 293 475(b)			(a)Estimated total particulates based on (b) (b)EGHGEI,2011
Transport	1778(c)	1449(c)	190 553(c)	57 103(c)	4 607 847(c)	169(c)	1475(c)	10 321 213(d)			(c) Thambiran & Diab, 2011 (d)EGHGEI,2011

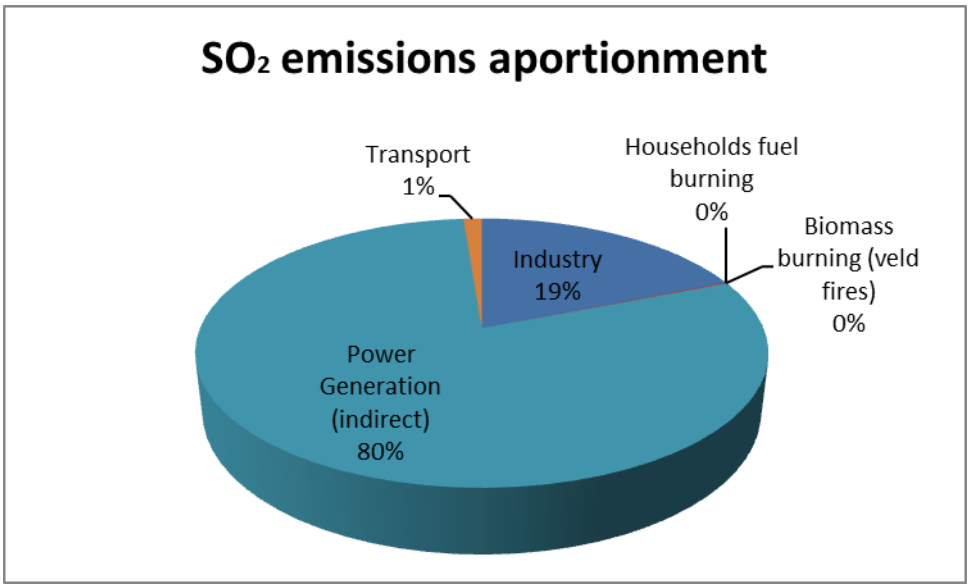

Figure 3:SO_2 direct and indirect emissions per sector from Durban

Durban's total greenhouse gas emissions for 2011 by sector provides an indication of the different sources of GHG emissions which can help to point toward the sources of air pollution in the Durban, although, for reporting purposes, not all air pollutants are included as GHG's.

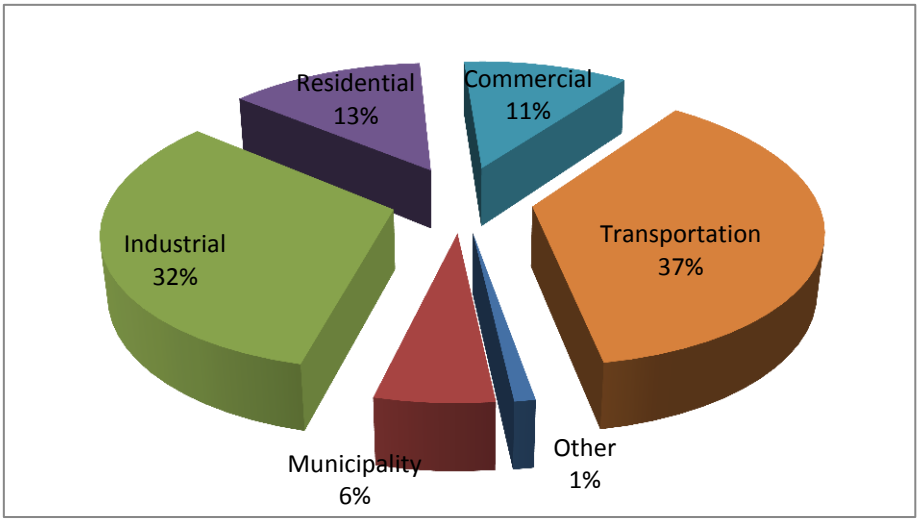

Figure 4: Durban's Total Carbon emissions by sector for 2011 (eThekwini Municipality, 2013)

Section Two: Key Climate Change Challenges for Waste and Pollution Theme in Durban

The impact of a growing middle class on waste production and pollution

There is a proven relationship between income and volume and composition of waste generated, and as consumption rises with increasing affluence waste volumes increase commensurately, the wealthier communities are the biggest generators of household waste. Increasing levels of urbanisation is leading to population growth which in turn leads to higher volumes of waste being generated. Durban's population is growing more affluent with increasing numbers of people moving into the middle class which is associated with increased levels of consumption. This is resulting in higher levels of waste generation and associated greenhouse gas emissions along the supply chain as demand increases.

Addressing waste management along the entire waste hierarchy

There is a global trend to concentrate on waste management strategies lower down in the waste hierarchy that have a lesser impact, such as landfilling and waste to energy strategies, than those at a higher level, such as waste prevention and waste re-use.

Furthermore, increasing levels of consumption and urbanisation are leading to increased volumes and hazardous content of waste streams, resulting in an increasing need for landfill sites, which are increasingly expensive to construct and operate. Therefore, there is a need to minimise waste production in Durban in order to decrease the environmental, social and financial costs of waste disposal.

Capturing methane emissions from landfill sites

When refuse decomposes at landfill sites landfill gas is released which is a combination of methane (CH_4), carbon dioxide (CO_2) and other organic compounds. CH_4 is a greenhouse gas that has a high global warming potential of 21 times that of a single unit of CO_2. In order to reduce the amount of methane that is released from landfill sites, the landfill gas is burned and the methane component extracted and converted into an energy source. Through this process the methane component is converted into water and CO_2 which reduces the greenhouse gas impact of the landfill. Generating electricity from landfill gas also reduces a municipality's reliance on electricity from coal powered plants.

eThekwini Municipality is currently using landfill gas from Bisasar landfill and Mariannhill landfills to generate 7.5MW of electricity, generating more than 40 million kWh of electricity in 2011. Despite the reduction in landfill gas, there are still large volumes released and unused. According to Durban's Greenhouse Gas Emission Inventory for 2011, 534 498 tons of CO_{2e} was released for the year 2011 from waste facilities, the proportions of which are showed below (This figure relates to emissions following landfill gas capture and combustion in either power generation plant or flare systems).

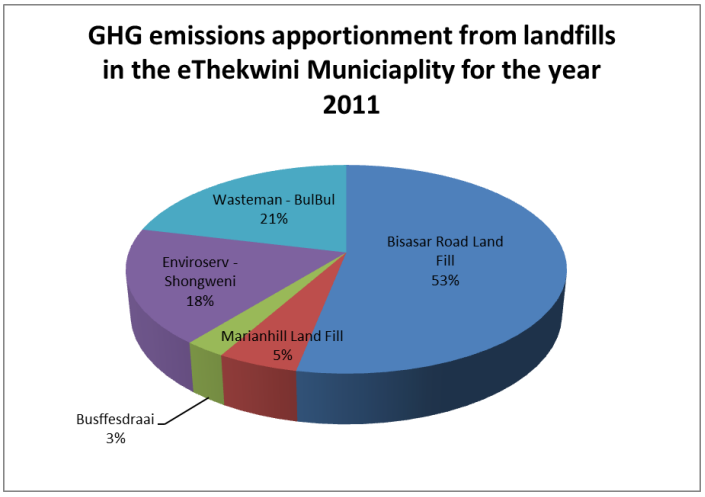

Figure 3: Greenhouse Gas emissions apportionment from landfill within Durban (eThekwini Municipality, 2013)

The impact of localised energy generation on air pollution

In the climate change context there is a drive towards the promotion of localised energy generation in the form of renewable energy in order to mitigate the impacts of climate change. Presently, the vast majority of electricity used in Durban is generated by Eskom, outside of Durban and, accordingly the air pollution associated with electricity generation processes are thus not experienced within Durban (Figure 4). Localising energy generation (whether by primary energy generation from fossil or renewable fuels, combined heat and power generation or waste to energy projects) would increase local emissions of criteria air pollutants and have an increased impact on air pollution in Durban without stringent management.

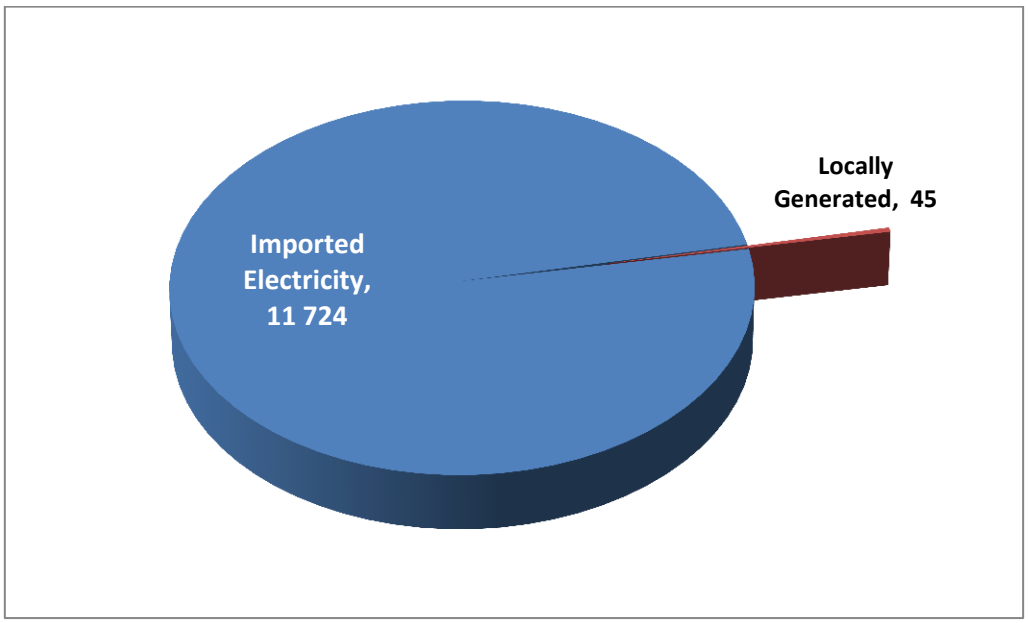

Figure 4: Electricity supply by source in Durban in GWh's (eThekwini Municipality, 2013)

Adaptation challenges

Whilst much of the focus with waste, pollution and climate change is on mitigation efforts, there are also adaptation issues that should not be overlooked. With increased temperatures and an increase in the severity of storms projected for Durban (IPCC, 2013), there are a number of areas that need to be addressed in terms of adaptation responses. These include:

- The increasing surface temperatures associated with current climate change may increase the breakdown of landfilled waste, accelerating the formation and release of CH_4.
- Projected increases in storm severity and rainfall could result in more waste being washed into rivers and into the sea if not collected timeously. Waste collection services may be required to collect waste more frequently to avoid pollution into rivers and blocking of storm water drains. Furthermore there is a need for greater education and awareness raising on the impact of litter in streams.
- Durban storm water infrastructure is predicted to see an increase in variability of stormwater discharge with larger discharge events associated with more extreme precipitation events. Increasing maintenance and infrastructure will need to be included in Durban's future planning. This need for infrastructure upgrade and maintenance is founded on two concepts. Firstly, provision needs to be made for unblocking blocked drains until the education campaigns in the above point make a significantly positive difference. Secondarily, if adequate infrastructure does not allow for increased rainfall, there will be an increase in waste from unnecessary flood damage.
- The observed increasing global surface temperatures are likely to cause an increase in air pollution from industry, the reason being that increased temperatures enhance the ozone formation chemistry. As ozone is formed from nitrogen oxides (NOx) and volatile organic compounds (VOCs), the need to reduce these pollutants in our atmosphere becomes even more important in the face of climate change.
- If increased air pollution levels associated with fuel combustion (whether by primary energy generation from fossil or renewable fuels, combined heat and power generation or waste to energy projects) are not controlled, there may be a significant impact on the health of Durban's residents.

Section Three: Waste and Pollution Vision and Aims

Durban has an effective waste management system where resources are focused on reduction, reuse and recycling strategies that effectively reduce greenhouse gas emissions in all economic sectors, divert waste from landfill, and create employment opportunities.

Aims:

1. Waste and pollution generated by Durban residents and organisations is minimised, and waste reused and recycled.
2. Opportunities to recover energy from waste in Durban are promoted.

3. Durban's strategies to mitigate climate change do not negatively affect air quality and human health.
4. Durban's waste management system and supporting infrastructure are resilient to the projected impacts of climate change

Section Four: Waste and Pollution Strategies to achieve the aims

Participants in the stakeholder workshop identified a number of strategies that could contribute to achieving the waste and pollution vision and aims as they relate to reducing greenhouse gas emissions from the sector. These strategies were combined with recommendations from the waste and pollution technical expert and have been synthesised to provide the list in the table below. For further background reading on waste and pollution and climate change in Durban see the technical introductory report available on the DCCS website.

Aim	Proposed Strategies
Waste and pollution generated by Durban residents and organisations is minimised, and waste reused and recycled.	• Accurate waste and pollution statistics for Durban are established in relation to greenhouse gas emissions and large emitters and polluters identified and controlled. • Waste, water and air pollution legislation and regulations to minimise waste are enforced and perpetrators fined. • Organisations reduce their waste at source through innovative reduction approaches, such as, making changes to the design of packaging. • Waste is viewed as a resource and opportunities for waste reuse by other organisations and industries are proactively identified. For example, organic waste is diverted from landfill and used for composting and building rubble is recovered for use as source of aggregate in new developments. • There is a functioning separation at source recycling service for all residents and organisations where paper, cans and glass are collected and recycled, supported by well distributed recycling drop-off stations that create multiple job opportunities. • Waste collection services are provided in all residential areas to avoid the burning of waste and prevent natural resources from being polluted. • Grey water and storrmwater is reused at a household and organisation level where possible. • All Durban'sresidents and organisations are educated and understand the concept of the waste hierarchy, and their role in reducing waste and greenhouse gas emissions. They understand the need to reduce their levels of consumption, value waste as a resource, and separate their waste at source for recycling. This is achieved through waste management awareness campaigns.
Opportunities to recover energy from waste in Durban are promoted.	• Implement the recovery of energy at all landfill sites and waste water treatment plants that conform to environmental and air pollution standards. • Promote the use of anaerobic digesters for energy generation from organic waste and garden refuse.

Durban's strategies to mitigate climate change do not negatively affect air quality and human health.	• The impact of mitigation strategies on air quality and human health are taken into account in the planning phase through catering for waste recovery and cogeneration projects in air quality plans. • Stringent air quality management to limit air quality impact associated with localising energy generation (whether by primary energy generation from fossil or renewable fuels, combined heat and power generation or waste to energy projects) as this may increase local emissions of criteria air pollutants and increase health impact without adequate abatement, plant siting and other relevant air quality management considerations.
Durban's waste management system and supporting infrastructure are resilient to the projected impacts of climate change	• Future waste management and infrastructure planning should take into account the impact of increased waste entering storm water drains due to increased storm events. • Due to variability in precipitation events and potential increasing volumes of water passing through the stormwater drains, stormwater drains and drainage systems will need to be closely monitored, and upgraded where necessary • Durban's Air Quality Management Plan should take into account potential increases of NOx and VOC's as a result of increased temperatures. • Infrastructure to capture CH_4 at landfills should be implemented to counteract temperature related acceleration in CH_4 formation

References

eThekwini Municipality, 2013. Summary Document: eThekwini greenhouse gas emissions inventory 2011. [Online] Durban: EScience Associates Available at: http://www.durban.gov.za/Resource_Centre/Current%20Projects%20and%20Programmes/energyoffice/Pages/GHG-Inventory.aspx [Accessed September 2013].

Fischer T, and Sanchezm A. 2013. Durban Climate Change Strategy Introduction Report Theme Waste and Air Pollution.

UNEP, 2010. *Waste and Climate Change, Global Trends and Strategy Framework*, United Nations Environment Programme.

IPCC 2013, Working Group 1 Contribution to the IPCC Fifth Assessment Report. Climate Change 2013: The Physical Science Basis. Summary for Policymakers

UNEP, 2010. Waste and Climate Change, Global Trends and Strategy Framework, United Nations Environment Programme.

PCSD 1996 President's Council on Sustainable Development. Eco-Industrial Park Workshop Proceedings. http://infohouse.p2ric.org/ref/06/05505.htm#iv

Pauli, G. 2000. Upsizing: The Road to Zero Emissions, More Jobs, More Income and No Pollution. Publisher: Greenleaf (January 1, 2000)

Roper 2012. Entropy, Complexity and Sustainable Development http://www.roperld.com/science/minerals/EntropySustain.htm

McRobert, C. 1992. MES, York University, Toronto, 1992. http://www.lacieg2s.ca/w3terra/gmt0.htm, http://www.lacieg2s.ca/public/w3terra/gmt1.htm, http://www.lacieg2s.ca/public/w3terra/gmt2.htm)

Appendix One: Minutes from Waste and Pollution Theme Working Group Meeting: 29th October 2013

#	Item	Action
1.	**Welcome** Derek Morgan from the eThekwini Municipality's Energy Office welcomed everyone to the meeting and introduced the Durban Climate Change Strategy Project to the stakeholders. The project is an initiative by eThekwini Municipality's Energy Office (EO) and Environmental Planning and Climate Protection Department (EPCPD) and has been contracted out to Urban Earth and FutureWorks! to facilitate the development of the Strategy. He explained that the purpose of the Durban Climate Change Strategy (DCCS) project is to develop a Climate Change Strategy document that will provide guidance for the city as a whole, to mitigate against and adapt to climate change. Derek Morgan encouraged stakeholders to participate in the meeting as their comments will be used to identify aims and strategies for the Waste and Pollution theme.	
2.	**Introductions** Margaret McKenzie provided a brief overview of the process that had been followed by the project up to this point. She explained that the project had been initiated with public consultation where stakeholders were asked to provide input on what should be the key focus areas of the strategy. The results of stakeholder feedback were then presented at a Reference Group meeting. The Reference Group was made up of a group of people who volunteered from different sectors to provide guidance to the strategy development process. Following advice from the Reference Group seven key themes were identified for the strategy: 1. Biodiversity 2. Health 3. Food Security 4. Water 5. Sustainable Energy 6. Transport 7. Waste and Pollution Margaret explained that the DCCS project was now in the process of hosting public working group meetings on each of the seven to develop aims and strategies for each of the themes. Seven technical experts have been procured by EPCPD and EO and will provide expert technical advice on each of themes. Margaret added that a second round of working group meetings will be held in the new year where stakeholders will get an opportunity to comment on the written theme report and add additional content.	

	Margaret explained that the Waste and Pollution working group meeting was the fourth of the seven theme working group meetings to be held and introduced Theo Fischer as the technical expert responsible for providing advice on the Waste and Pollution theme. Margaret added that in the environmental management field there are many waste and pollution issues that can be discussed but that the focus of this workshop is to concentrate on specific waste and pollution issues that are linked to climate change.	
3.	**Presentation** Theo Fischer presented a summary of the Introductory Report for the Waste and Pollution Theme and focused on the following aspects: • Waste, waste water, and air pollution status quo in Durban • Key waste, waste water and air pollution challenges facing Durban • Key waste, waste water and air pollution strategies that have been implemented in Durban • International strategies for waste, waste water and air pollution The Waste and Pollution Presentation and Technical Report can be downloaded from the DCCS Website.	
4.	**Comments and Questions** The floor was then opened where stakeholders were invited to ask questions. The following issues were raised by stakeholders during discussion and responses made by the technical expert and eThekwini Municipality officials. **Comment**: In the Durban community incinerators are a "dirty" word, they are called autoclaves. Durban Solid Waste (DSW) claims they collect 100% of household's waste, but the figures in the presentation are different. Where have you sourced your figures from? **Response**: The word "incinerator" is used in this presentation as it is the legal term. The waste collection figures that we have are from surveys conducted. We are aware that in informal settlements and rural areas, not all waste is collected. **Comment**: One of the greatest issues is that we don't have accurate waste figures in South Africa, in terms of waste generated and waste that is recovered. eThekwini Municipality needs to establish waste benchmark figures so that we can make the required responses. **Response**: There are indeed issues with sourcing accurate waste figures in South Africa, however for the purposes of the development of a climate change strategy we have enough waste information to work with. **Comment**: We know that climate change is going to happen but the issue is how do we reduce advanced climate change? Most of the focus of the presentation	

	was on post-consumer waste and the reduction of waste received little attention. Unless there is a radical change in how we approach issues of waste and pollution, the reactive strategies that we implement such as recycling will not have a large enough impact to make a difference. **Response**: We need to apply the waste hierarchy where avoidance of waste is the first step, but we also need to accept that South Africa is a developing country and there needs to be investment in economic development.	
5.	**Group Discussion** Margaret McKenzie asked stakeholders to form groups of six people each. Groups were allowed 20 minutes for identifying strategies to address the key issues relating to waste and pollution and climate change, and five minutes to capture these strategies on key cards. The stakeholders were given flip chart sheets to record their discussions (See Appendix B) prior to noting their top three strategies on key cards. A representative of each group was then asked to present their group's top three strategies. The various strategies proposed by the groups are presented below. They have been grouped into common areas: **Establish accurate waste and pollution statistics for Durban** • Pin point status quo – DEA/CSIR study? (Need to look at pinpointing where we are – need to look at a status quo) • Air Pollution – what are the big emitters of CO_2 and CH_4: We are assuming what they are, so we need to identify the causes, prioritise the important ones and form a strategy on what to do about it **Converting waste to energy** • Anaerobic digestion of biomass and other alternatives • Anaerobic digestion of organic waste – waste to energy • Permaculture strategies – building soil at source organic material treated on site, waste as a resource, grey and black water used • Landfill sites: CO_2 better than CH_4, energy recovery/flaring, invasive alien campaign, compost: vegetables and plant recovery (Regenerate land that has alien plants, Vegetable patches using rich soil) • Find / use cleaner methods of producing energy from waste **Waste separation at source** • Separate at source, NB education and facilitation (Try to understand what could be done to encourage people to separate their waste) • Separation at source (Sole separation of waste – when we start separating it we can do something about it) • Orange bag system – should be maximised with fast-track addition of glass/cans. More education to encourage households to use the bags (must	

	make use of them more but keeps bags reusable) **Waste and Pollution Education and Awareness** • Educational awareness campaigns • Strategy of densification (lots of people in a small area) – is education: water, waste, transport, air pollution (Focus on areas producing the most waste – target them with recycling programs to reduce waste) **Re-use of waste materials** • Introduce a strategy where the waste of one industry becomes raw material for another • Builder's rubble 22% - should be specific site where it can be recovered or reprocessed. Legislation forcing use in new buildings **Regulations and enforcement** • Focus on the bulk producers of waste • The focus should be more on manufacturers to minimise waste going to landfills • Enforcement of regulations that deals with illegal dumping **Funding** • Funding for recycling	
6.	**Discussion** Margaret opened the floor for a final round of questions and comments to allow stakeholders the opportunity to mention any areas that had not been covered in the report backs. The issue of Biogas Digester licences and home use was discussed. The general consensus was that a large scale biodigester that is used to generate electricity would require a licence and power purchase agreement but a biodigester that is used to generate heat for a home on a small scale, would probably not require a license. The air pollution impacts of a biogas digester were also highlighted. Another issue raised in the discussion was the need for Durban residents to reduce their consumption levels so that there is less waste generated and therefore less waste that ends up at landfill. Industry packaging was another area that was discussed as packaging contributes to waste on a large scale. Packaging companies, brand owners and designers all can play a role in producing products with less packaging. A further comment raised was that an accurate emissions inventory for Durban is required so that emissions can be regulated. The last point raised was that renewable energy technologies, like hydro-electric power, have negative impacts and these should not be overlooked.	

7.	**Closure** Margaret outlined the process going forward. This included the following: • A short report summarising the content provided by the groups will be prepared. • The technical specialist, Theo Fischer, will review the report and provide comments and recommendations. • The report will then be uploaded on the website and emailed to everyone for further comment. • A follow-up meeting will be held early next year to present the draft strategy and to collect any comments and suggestions on the waste and pollution component of the strategy. Derek then closed the meeting, thanked everyone for their participation, and thanked the Botanical Gardens for subsidising the venue for the event.	

Appendix A- Register

Apologies: Allen Pembroke, Joel Ndlovu, Mduduzi Mzolo, Sarisha Perumal, Jayaseelan Hennie Naidoo

Name	Organisation
Amanda Botes	Urban Earth
Angela Brown	Re-SA
Slindile Thandeka Buthelezi	Department of Human Settlements
Chris Cox	Paw Tech
Heidi Cox	Paw tech cc
Bruce Dale	eThekwini Health Unit
Asanda Debe	Eskom Holdings Limited
Frank Edwards	Resident
Theo Fischer	Escience
Anthony Freddy	Elgin Brown & Hamer
Vusumuzi Gcuma	KSEF
David Hallowes	
Kathryn Kasavel	Urban Earth
Amir Khan	Grove end Sec
Asia Khan	DAEA eThekwini
Elliot Khanyi	Transnet
Jean Lindsay	KZN Conservancies Association
Mark Liptrot	Afripack
Mlungsi Mahlobo	EWS
Thami Mankanku	TCE eThekwini
Thembelethu Maphenga	Bhekithemba C.P School
Khulile Mavundla	Futureworks
Margaret McKenzie	Urban Earth
Linda Mhlongo	LMH
Yegeshni Moodley	NPC
Derek Morgan	eThekwini
Jean Pierre Mulumba	umoya-nilu
Paul Ngema	Nafcoe
Londiwe Ngwane	Student
Liz Palmer	350.org
Geoff Pullan	
Yusuf Raja	ARUP
Thebe Shale	
Mohil Subban	Personal Capacity
Duane Thomas	Private
Jonathan Welch	AfriEco
Chris Whyte	USE-IT
Kirk White	Architect

Appendix B: Flip chart sheet discussion notes – Strategies

Group 1

What motivates people?

- Separation at source
- Funding for recycling and buy back centres

Group 2

Air pollution

- What are the big emitters:
    - Assuming what they are
    - So we need to identify what causes
    - Prioritize the important ones
    - Strategy
- Waste water
    - Grey and black water systems for new and substantial buildings
- Transport
- Waste to energy
- Bio-digester
- Densification education
    - Water
    - Waste
    - Transport
    - Air pollution
- Waste
    - Permaculture as a strategy
    - Treat waste on site –organic Hugelkulture
    - Treat waste water on site
    - Sorting waste at source – product made – product is used
    - Resource money
    - Material recovery
    - Waste to energy

Group 3

Waste

- Need to measure and benchmark exact status quo regarding actual contribution of waste to GHG
- Manufacture new versus recovered (ref: DEA/CSIR studies)
- Garden refuse and other biomass
    - Energy generation
    - Organic fertiliser
    - Anaerobic digester (energy, fertiliser)
- NB: separate all waste at source

- Waste water treatment – power generation (digesters)
- Legislation/bylaws to specify the percent of content of recovered materials
- Recycling
    - Municipal collection
    - Education
    - Drop-off points at every shopping centre

Group 4

CO_2 better than CH_4

- Landfill sites energy recovery or flare
- Invasive alien programme – remove and replace with plants from landfill sites
- Compost from above sold to visitors to site - food grown on landfill sites?
- Builders rubble – should be specific site where it can be recovered or reprocessed. Legislation to force the reuse of rubble
- "Orange bag" system – more encouragement needed to encourage people to recycle. Fast-track addition of metal / glass
- Not enough people take climate change seriously – more education needed.

Group 5

Waste

- The focus should be more on manufacturers (for waste minimisation)
- Strategy to prevent illegal dumping (enforcement of regulations that deals with illegal dumping)
- Separation of waste from source
- Education awareness campaigns
- Recovery of waste for compost

Group 6

Strategies for waste and pollution

- Find ways to create cleaner energy because power generation produces greenhouse gases
- Introduce a strategy where the waste of one industry becomes raw material in another industry
- Incentives for the pricing of waste
    - Example: waste tyre levy
- Focus on the bulk producers of waste
- Permit for emissions (AEL) should include GHG emissions mitigation plan
- Agricultural practises to include
    - Crop residue burning
    - Road reserve / fire break burning – strategy: baling