South African CitiesNetwork

A Case for Municipal Solid Waste Management

In Analysing Cities Financial Implication of Transitioning to a Green Economy

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Acronyms

CDM	-	Clean Development Mechanism
CER	-	Certified Emission Reduction unit as issued under the CDM standard
CFSSD	-	Committee on Food Security and Sustainable Development
CSIR	-	Council for Scientific and Industrial Research (SA)
DEA	-	Department of Environmental Affairs (SA)
DST	-	Department of Science and Technology (SA)
DSW	-	Durban Solid Waste
EU	-	European Union
GCF	-	Green Climate Fund
GEF	-	Global Environment Facility
GHG	-	Greenhouse Gas
ISWA	-	International Solid Waste Association
MFMA	-	Municipal Finance Management Act
MSW	-	Municipal Solid Waste
M&V	-	Monitoring and Verification
NAMA	-	Nationally Appropriate Mitigation Action
NAPA	-	National Adaptation Programme for Action
NGO	-	Non-Governmental Organisation
OVAM	-	Openbare Vlaamse Afvalstoffenmaatschappij (Flanders Public Waste Association)
PAYT	-	Pay As You Throw
PPP	-	Public Private Partnership
PSWM	-	Participatory Sustainable Waste Management
RDI	-	Research, Development and Innovation
ST&I	-	Science Technology & Innovation
UNEP	-	United Nations Environment Programme
UNDP	-	United Nations Industrial Development Organisation
UNESC	-	United Nations Economic and Social Council

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Executive Summary

This is a technical Paper focusing on Municipal Solid Waste (MSW) management in the context of its contribution and financial implication to cities' transition to the green economy through this sector. The South African Cities Network (SACN) intends to use this input into the chapter on Green Economy for the upcoming State of City Finances publication, 2015. The Paper is one of three, commissioned during the 2013/2014 financial year with the same objectives but with a different area of focus, which is energy and climate change adaptation.

There is a global trend in the waste sector - a shift from a collection and disposal dominated waste hierarchy to a waste hierarchy dominated by waste minimisation and recycling. The common waste management evolution trajectory follows a path from landfilling to a mix of recycling and incineration, gradually substituting the practice of landfilling. Several industrialised countries have successfully implemented policies and regulations reducing landfilling to levels below 20% and increasing recycling to levels above 45% while the remainder is covered by incineration.

Most countries within Africa are still have only begun making the shift and rely almost fully on landfilling with a small percentage of recycling achieved mainly through the informal sector. Against this background, South Africa is performing well, with relatively good handle on conventional waste collection and disposal. Approximately 10% of all its waste generated is recycled. While this forms a good basis moving forward to green MSW management practices, it also illustrates that when looking for examples of good practice one should also look beyond the continent.

Global best practices as well as studies relating to green waste management initiatives in the developing world show the importance of mechanisms to recover cost and financially incentivise waste producers to change waste generation behaviour and make initiatives financially sustainable. In the case of Pay As You Throw (PAYT) schemes based on the 'polluter pays' principle, cost recovery and financial incentives go hand in hand. An interesting, often highlighted example is the Belgian province of Flanders, which has been very effective in using PAYT schemes in conjunction with other initiatives to increase selective collection and recycling from 34% in 1995 to around 70% in 2002 after which the percentage stabilised.

Although the application of cost recovery mechanisms can make green waste management initiatives sustainable and limit the impact on the net operational cost for the account of municipalities, it is generally recognised that in addition, substantial investment in infrastructure is required upfront. These investments both concern soft (organisational) and hard (equipment, civil) infrastructure required for the implementation of new organisational processes and technologies. International funding and the involvement of the private sector can assist in the realisation of required investments in new infrastructure.

There are a wide range of drivers behind the transition towards green waste management practices in the local context, as well as the sector's contribution to the green economy. Desk research shows that in the South African context, there are two drivers that stand out, over and above the envisaged environmental and job creation benefits:

- Extension of the lifetime of existing landfills as there is a lack of suitable locations for new landfill sites and in this way the remaining space available on existing landfill sites.

- Reduction of waste management costs whereby municipalities are seeking alternative waste management solutions which reduce waste volumes and thereby treatment cost.

The study identified 23 projects across the country that are contributing to the transition towards green waste management practices. 11 out of the 23 projects fell within the energy recovery category. Most of these projects were so-called 'landfill gas to energy projects,' whereby the methane released by microbial activity is converted into electricity. About half of these projects were executed by the private sector and the other half were ran in a partnership between a municipality and the private sector. Although difficult to distinguish as the only rationale, it is relevant to consider that these projects are in many cases (for a substantial part at least) funded from the expected revenue from the sale of carbon credits under the Clean Development Mechanism (CDM).

Two interesting practical implications can be summarised from this dependence on additional revenue, which might be true for projects geared towards the transition to greener waste management practices. Firstly, the dependence on additional revenue streams that originates outside of the traditional revenue streams with the MSW sector (e.g. tipping fees) indicate that the costs associated with the implementation of the project are higher (either from a capital expenditure and/or operational expenditure perspective) than continuing on the same basis without the project. Secondly, the generation of additional revenue from the sale of CERs Certified Emission Reduction unit as issued under the CDM standard)**,** indicates that municipalities that have implemented these kind of projects or are planning on doing so, have managed to find ways to deal with constraints from the Municipal Finance Management Act 2003 (MFMA). These constraints include limitation of contracting periods and structures geared towards prudent procurement rather than sales). The methods applied by municipalities in this regard ranged from applying alternative project structures, requesting an exemption on the MFMA or focus on being compliant with the objective(s) of the MFMA rather than the detailed procedures and requirements.

The study also tried to identify a set of factors that drive the successful implementation of projects that move towards greener waste management practices. Although five success drivers were identified, the most pertinent driver revolved around the economic feasibility of a project and the institutional capacity to determine and secure the economic feasibility upfront as well as to execute the project in such a way that it remains economically viable over time.

It is important to take into account that, although detailed information is sketchy and not frequently available, the global and domestic pattern indicates that projects implemented towards greener waste management practices are most likely to be more costly than continuing with the current waste management practice. It is therefore critical that project opportunities are assessed on a case-by-case basis and that only those with clear economic feasibility are executed.

One of the main conclusions of the Paper was that while acknowledging the promises of a green economy, the transition towards sustainable MSW management practices demands substantial engagement and preparation in both the public and private sector. In order to reap the rewards of a green economic transition in the waste sector, substantial investment is required in both soft and hard infrastructure. Moreover, the right

implementation models need to be applied and these include cost recovery and law enforcement precautions to ensure the sustainability of initiatives.

When the aforementioned conditions are met, international examples show that waste management cost to municipalities can be reduced in the long term and that green waste management practices can make a significant contribution to the green economy.

Local practice includes examples of projects developed as Public Private Partnerships (PPPs) as well as projects developed by the municipality itself. Although project development in all cases cost a considerable amount of time due to, among others, the innovative nature, in both cases several projects have been successful in its realisation and continuation over the years. Nevertheless, it was not possible to assess or compare on equal terms, the exact financial implications for the relevant municipalities.

The Paper did however, identify several requirements to reach the goal of developing green waste management initiatives contributing to the green economy and municipal finances in a positive way both taking an international and domestic perspective. Key requirement areas include:

- Building organisational capacity/skills.
- Removal of regulatory restrictions in the MFMA.
- Solid development and implementation plans including measurement, reporting and verification procedures
- Unlocking investments in the green economy through industry and international funding agencies
- Building external skills and sensitisation of stakeholders.

1. Policy & Regulatory Framework – International Status Quo

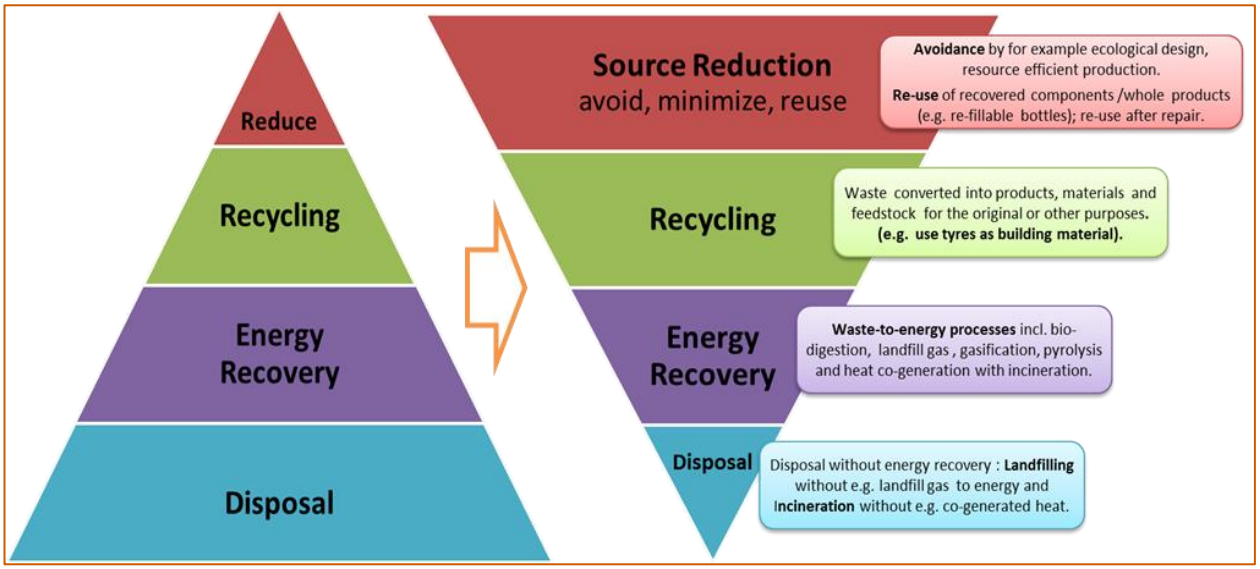
This section is a summary of the current status of waste management practices globally and the specific challenges encountered in the developing world and the African continent.

1.1 Global trend in waste management

The green economic transition taking place globally provides a strong lever for economic development and results in an adjusted national development scene. Within this context, the waste sector in particular, is a recognised area of interest to municipalities. Municipalities fulfil a major role in waste management and are traditionally the local actors with the prime responsibility for waste collection and management. Moreover, transformation of the waste sector provides the opportunity to create low and higher skilled jobs while at the same time increasing living standards, thereby providing an instrument for the upliftment of communities and their citizens.

The global trend in the economic transition taking place in the waste sector is a shift from a collection and disposal dominated waste hierarchy to a waste minimisation and recycling dominated hierarchy as illustrated in Figure 1 below.

Figure 1: Waste hierarchy - Shift from a conventional to a resource efficient hierarchy



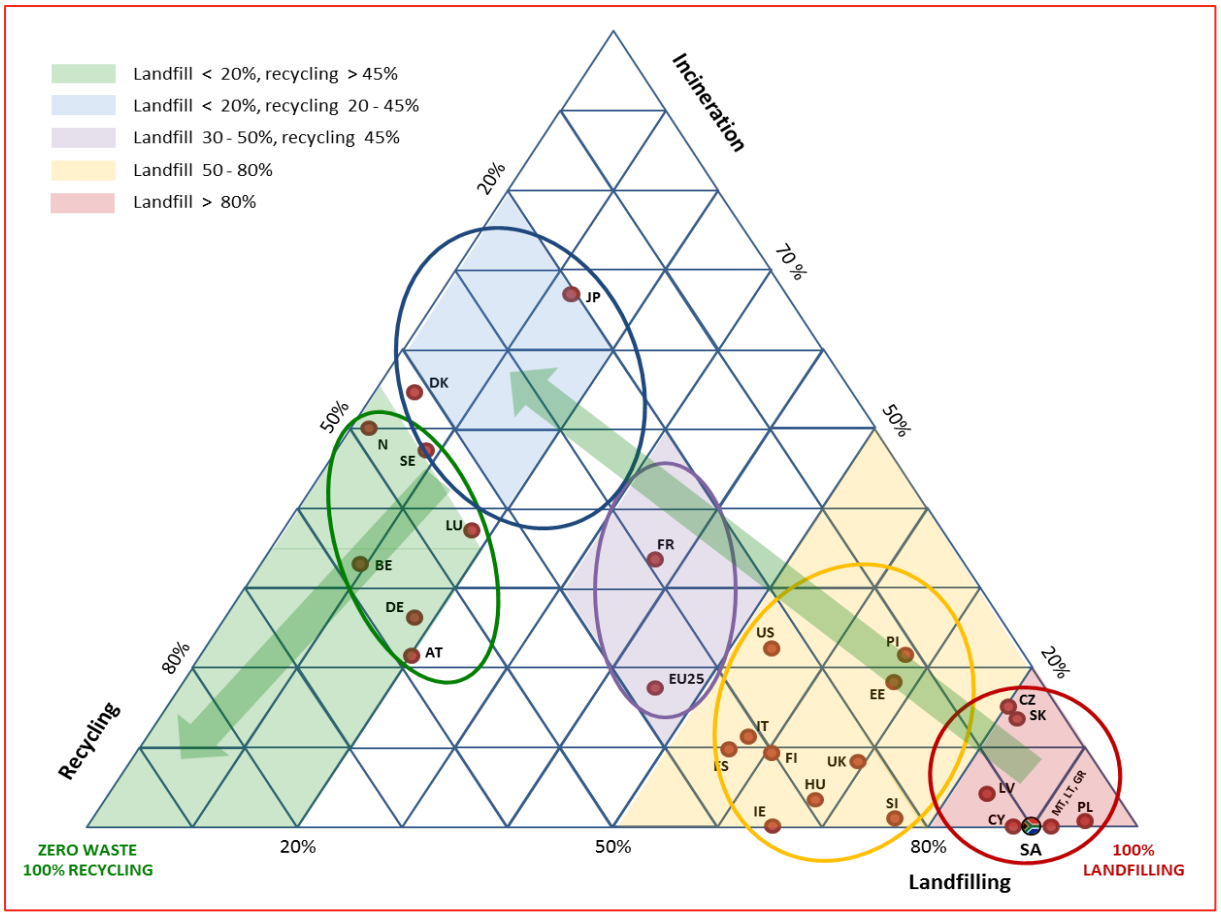
The conventional waste hierarchy is focused on disposal via landfilling and/or incineration[1] with a minimum effort of extracting value by recycling and/or energy recovery from waste, let alone activities to minimise the generation of waste at source. In the ideal situation, this hierarchy is turned upside-down with a strong

[1] Under disposal, landfill and incineration without any energy recovery activities are categorized. Energy recovery includes landfill gas to energy and the production of co-generated heat in incineration plants.

emphasis on resource efficiency by means of reducing waste produced and recycling of used product and materials.

Several industrialised countries have implemented policies and regulations promoting this shift successfully up to the extent that landfilling is reduced to levels below 20% and recycling increased up to a level above 45%. Figure 2, derived from the International Solid Waste Association (ISWA) Paper (2011), illustrates the status of global quo regarding the shift towards recycling away from landfilling. The green arrows show the common waste management evolution, from landfilling to a mix of recycling and incineration and ultimately increasing the percentage of waste recycled further. The final trajectory (second green arrow) represents the route towards a 100% recycling (bottom left corner) by phasing out incineration and landfilling completely.

Figure 2: Status quo of the shift towards recycling focussed waste management (2011)[2]



South Africa currently relies mainly on landfilling with approximately 10% of its waste being recycled (Department of Environmental Affairs (DEA, 2012) and is therefore positioned in the red zone in Figure 2. Belgium is one of the European countries that have been very successful in making a shift towards recycling and waste minimisation reaching a recycling percentage of around 56% in 2011 (Federal Plan Bureau Belgium, 2010 and 2014). This shift was achieved by a range of measures introduced from 1997 onwards

2

incentivising recycling by households and introducing PAYT schemes together with a communication strategy sensitising communities and businesses to participate in waste recycling and minimisation. A large contribution was made by the Belgian province, Flanders, which has rolled out consecutive waste implementation plans focused on reducing residual waste since 1986 (see Box 1 below).

Box 1 - Household waste management in Flanders

1986-1996: Waste Implementation Plans

- Levies on landfills and incineration
- Producer responsibility principle and waste prevention
- PAYT (pay as you throw)
- Introduction selective collection

1997-2002: 1st Household Waste Implementation Plan

- Obligatory selective collection
- Landfill and incineration prohibitions

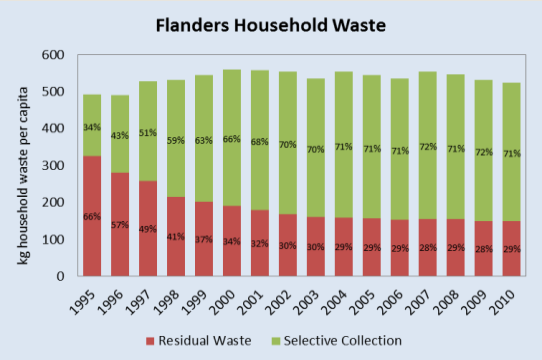
2003-2007: 2nd Household Waste Implementation Plan

- Target setting: 70% selective collection & recycling
- Absolute prohibition of landfill of household waste by 2006

2008-2015: 3rd Household Waste Implementation Plan

- Introduction of the Cradle to Cradle principle
- Decoupling waste production from economic growth
- 2% prevention of waste production per year

With a mix of instrument Flanders increased selective collection and recycling from 34% in 1995 to 70% in 2002.



Source: OVAM, 2011.

Furthermore, in the USA, some PAYT initiatives have been reported to be very effective, resulting in increased recycling rates, in Portland, Oregon from 7% to 35% and in Falmouth, Maine from 21% to 50% in just one year of implementation (Shawnee Kansas, 2009). PAYT initiatives however, do require law enforcement precautions against illegal dumping and misuse of recycling facilities.

1.2 Cost and financing of waste management

It is important to note that the original early drivers behind alternatives for landfilling stem from the fact that the practice of landfilling became socially unacceptable and appropriate space for new landfills have therefore become scarce. This has commonly led to a combination of recycling and incineration solutions (with or without energy recovery) in order to face the challenge of the necessary phasing out landfilling practices. In addition, environmental concerns and economic incentives provided by the value extracted from recycled materials/products have boosted the recycling of waste. Still, making the shift will, firstly result in an additional cost before a financial gain is created on the longer term.

As reported in several studies, introducing green economy principles in the waste sector will require substantial investments in new infrastructure while developing countries generally already struggle with budgets for the delivery of basic collection and disposal services. The following ways of dealing with this financial challenge include:

- Cost recovery mechanisms like PAYT rates, tipping fees and local taxes.
- International funding to assist in infrastructure and services investments.
- Involvement of the private sector, thereby unlocking private sector capital.
- Innovative financing: e.g. carbon financing, micro financing and small project financing.

1.2.1 Cost recovery mechanisms

Cost recovery mechanisms like PAYT, which place a price on waste generated by polluters can be very effective, especially with the differentiation of rates depending on amounts and type of waste. In the context of a developing country, one may also need to differentiate in rates depending on income group in order to ensure that vulnerable groups are not negatively affected, while nevertheless all income groups keep motivated to change behaviour.

Costs recovery mechanisms can create substantial income to finance waste management practices. Moreover, an important additional financial benefit is created through the reduction of residual waste and the resulting lower volumes of waste that need to be disposed of. Although cost recovery and cost reduction is essential to make new waste management practices sustainable (covering at least operational cost), it often cannot cover the required upfront investment in new organisational and capital infrastructure to allow for efficient and effective recycling within a municipal context. Hence, unlocking financing and funding from the international community as well as the private sector is likely to remain essential in order to fast track a transition towards green waste management practices. Carbon financing and innovative ways of micro financing could further improve investment conditions (see section on 2.2.4 on Innovative Financing below).

1.2.2 International funding

Around USD$48 billion is spent by developing countries on municipal solid waste management and it is envisaged that this amount needs to almost double in order to repair the commonly encountered service delivery gap (Le Courtois, 2013). Moreover, considering the projected increase in municipal solid waste generation due to an increase in population and economic growth, financing needs may grow to USD$150 million yearly by 2025 (Hoornweg, Bhanda-Tata, 2012). ISWA (2013) reports that currently, 'only a small amount of international donor funds goes towards establishing waste management infrastructure and services', while significant funds are required to finance the shift to green management of MSW.

Within the context of international climate change negotiations, several international funding streams have been directed to support the green economy in developing countries. There is therefore an opportunity to channel this funding towards green municipal waste management. Some of the main funds directed to a green economy are:

- Green Climate Fund (GCF): a fund which emerged within the UNFCCC framework and recently became operational to receive donor funds and aimed at raising Climate Finance of USD$100 billion annually by 2020.
- Global Environment Facility (GEF): currently still the largest international funder of green projects but likely to be surpassed by the GCF once it is fully up and running.
- EU-SA Agreement on ST&I and Horizon 2020: within the context of the agreement and the Science Technology & Innovation funding available within the EU funding framework Horizon 2020, a National Waste RDI Roadmap has been developed by the Department of Science and Technology (DST) and the Council for Scientific and Industrial Research (CSIR).

GCF and GEF are more focused on funding investments required for the implementation of green projects, while funding available in the context of the EU-SA Agreement on ST&I, could assist in the challenge of developing new waste management technologies and ensuring the local uptake of Research and Development (R&D) required to apply novel technologies in the context of a developing economy.

In order to tap into these and other funds, viable project plans need to be developed with a clear financial scope and work programme adapted to the needs of the funders. In case of the GCF, a specific procedure for accessing funding has been developed based on Nationally Appropriate Mitigation Actions and National Adaptation Programmes for Action (NAMAs and NAPAs) which need to be developed in collaboration with national government.

Currently developing economies do not succeed to attract sufficient international funds to invest in green waste management activities. While this can be seen as a problem, it can also be seen as an opportunity to engage in solid planning and structuring of initiatives, which will enable countries and municipalities to tap into these funds.

1.2.3 Private sector involvement and investment

Involving the private sector can be a good solution to unlock investment capital and increase cost effectiveness of municipal waste management activities, however, it is not a silver bullet. Municipalities need to, among others, govern contracts with the private sector appropriately and maintain conducive conditions by enforcing regulations.

Requirements to promote successful private sector involvement mentioned in several studies covering practices in the developing world can be summarised as follows:

- Long-term contracts extending the pay-back time required for investments.
- Good contract management to ensure performance.
- Enforcement of regulations conducive to the waste management initiative.
- Multiple potential service providers are required for tenders to lead to competitive pricing.
- Not necessarily selecting the most innovative provider (choosing 'de-risked' options).
- Regionalising initiatives in order to create critical mass (e.g. waste volume and skills).

Although not all requirements mentioned are private sector involvement specific, they do have merit when it comes down to the successful implementation of new waste management initiatives.

PPPs are mentioned in many studies as a potentially successful concept for the implementation of existing and new waste management services. However, the definition of a PPP is broad and can entail a range of modalities. These include; the straightforward outsourcing of services to more complex engagements between municipalities and private-sector service providers sharing in upward and downward financial potential. A consideration in choosing the most suitable PPP option may also be assessing the internal capacity to effectively handle contractual and technical complexity.

1.2.4 Innovative financing

Carbon financing

Since the decline of global carbon compliance markets starting in 2009, carbon financing has become a less desired instrument to promote green investments. Nevertheless, tradable emission reduction units, for example CERs under the Clean Development Mechanisms, generated by green waste projects are generally considered as being more than a compliance driven commodity, and can still generate a relevant revenue stream when traded over the counter as a corporate or a governmental social responsibility driven purchase.

When a link can be made to carbon tax offsetting mechanisms – as with the case with Mexico and as also envisaged in South Africa - pricing of locally generated carbon emission reduction units can be significantly enhanced and increased to effectiveness of carbon financing in promoting green waste initiatives.

Micro financing / small project financing

Micro financing can facilitate the financing of small scale efforts by municipalities as well as small scale entrepreneurs in the waste sector. Waste entrepreneurs include those from the current informal sector, which need financial support in order to enable investment in more structured and mechanised waste management activities. For the informal waste recycling sector, this can be an instrument to prevent current waste collectors of losing their jobs and enabling this vulnerable group to also benefit from the green economy.

Two interesting examples:

- Credit Programme to Finance Local Government Investments in Waste Management:

  A programme financed by KFW Development Bank which provided refinancing through the Development Bank of the Philippines (DBP) for lending to fund investments. Funds were primarily targeted on local governments but also included private initiatives. The size of investment measures varied with an average value of EUR100,000 and ranging from EUR8,000 to EUR5 million. Types of measures financed included investments in vehicles, in equipment for waste collection and storage and in heavy equipment. (KfW Entwicklungsbank, 2011)

- Participatory Sustainable Waste Management (PSWM) project, São Paulo, Brazil (R. Hogarth, 2009):

  The PSWM project has been developed by a partnership between the Canadian University of Victoria and the University of São Paulo with support by Canadian International Development Agency. The programme assists waste collectors in collectively commercialising their materials and structuring the environmental service they provide. The approximately 30 cooperatives formed, ensure that the required quality and critical mass is formed to negotiate with off-takers making the around 500 collectors independent from 'middle-men' who offer lower prices. As the cooperatives organise payments to the collectors, waste collection at depots, further sorting of waste to ensure quality and transportation of large volumes to off-takers, all these processes require investment in operations and equipment. Microfinance therefore has been an essential component of the project sourcing working capital and emergency funds when needed.

1.3 Regulations and policies – institutional requirements

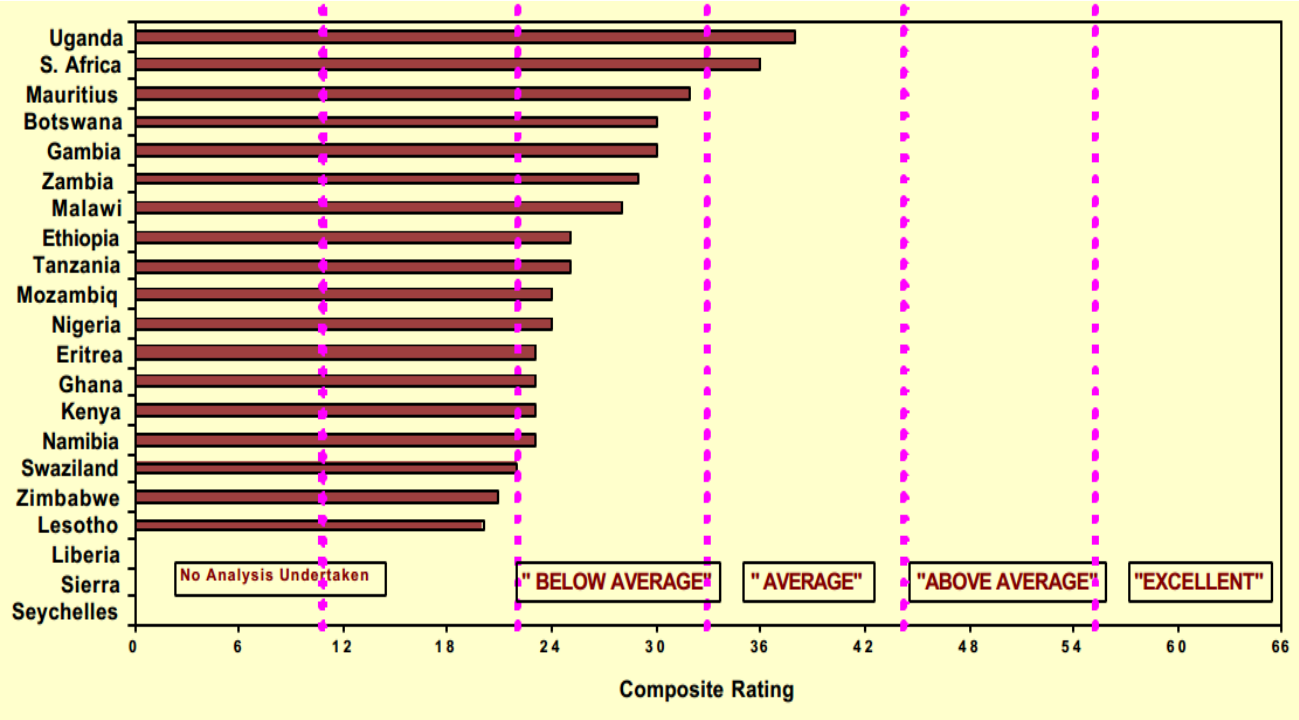
Regulations and policies on the municipal level generally are country specific as they tend to relate strongly to the relevant national legislation mandating municipalities to implement certain regulations and/or policies. Nonetheless, many regional and municipal initiatives result from policies developed on a national level.

National legislation can create a level playing field taking away certain implementation barriers for municipalities, which in many aspects also compete with each other when it comes down to attracting businesses and residents to grow their city. The introduction of green waste management practices and cost recovery mechanisms may not always appeal to industry and civilians in first instance as one generally experiences the burden before the benefit.

Essential to making the transition and successfully developing and implementing green waste management policies at the local level, is building municipal capacity to deal with the increased complexity that comes along with e.g. new models for service delivery, selection of service providers for services previously sourced in-house and the application of new technologies..

From an African perspective, South Africa is performing well on institutional capacity, having a relatively good handle on conventional waste collection and disposal among African peers (as illustrated in Figure 3). Approximately 10% of all its waste generated is recycled. Notwithstanding the required investments in new organisational infrastructure, this forms a good basis moving forward to green MSW management practices while at the same time it illustrates that when in search of good practices, one should also look beyond experiences on the continent.

Figure 3: Rating of waste management capacity in some parts of Africa (UNESC, 2009-1)



The Africa Review Report on Waste Management mentions the following important summarised recommendations for environmentally sound management of municipal solid waste in Africa. (UNESC, 2009-2). These recommendations are not unique and also replicated elsewhere in literature. In case a recommendation is added (not originating from the aforementioned report) a reference has been added to the specific recommendation. The summarised recommendations are listed in Table 1.

Table 1: Institutional and organisational recommendations regarding management of Municipal Solid Waste

Areas	Recommendations in Summary
Policy and Planning	Integrated waste management policies including the whole range of options in the waste hierarchy (source reduction, recycling, energy recovery and disposal).
	Inclusion of pro-poor involvement in waste management as a source of employment and income generation.
Legal Aspects	Strict enforcement of the law e.g. prevention of illegal dumping and export/import of waste.
	Continuous reviews and updates of legislation in order to keep up-to-date with latest developments and needs.
	Adopt the principle of extended producer responsibility.
Involvement of Key Stakeholders	Define and integrate clear roles from central to local levels including government, NGOs, communities and industry.
	Partnership approach going beyond formal roles/commitments which can be encompassed by Integrated Waste Management systems.
	Public-Private -Partnerships should be encouraged such that private sector can invest in recycling centres, landfills and incinerators.
Capacity Building & Training	On-going training of various stakeholders on environmentally sound management using existing institutions.
	Environmental agencies and local authorities should be strengthened to enhance participation of stakeholders in the implementation of waste management plans.
Public Awareness	Create strong public awareness to increase community participation and positive attitude.
	Continued training and sensitisation among media personnel to equip them with knowledge on emerging issues.
Staff and Equipment	Increase numbers of qualified personnel to manage and operate various waste management systems and equipment.
Finance and Cost Recovery	Unlock private sector investments by encouraging participation and addressing high cost of capital required for investments.
	Ensure sufficient funding for NGOs and media to enhance their advocacy roles.
	Introduce sufficient cost recovery mechanisms and/or financial incentives which make green waste management practices financially sustainable on the longer term.[3]

[3] This recommendation relates to multiple sources including: Dijk, van, Oduro-Kwarteng, 2007. Modak, 2011. UNEP, 2011.

2. Policy & Regulatory Framework – Domestic Status Quo

Globally, successful initiatives have been undertaken in which the private sector contributes to addressing the climate change impacts of the waste sector. In South Africa, this has only been successfully copied on a few occasions. Apart from a brief overview of national solid waste management green economy initiatives, this section contains a good practice case study of eThekwini's Bisasar Road landfill site.

2.1 Waste sector contribution to the national green economy

In line with international trends, the solid waste sector in South Africa is aiming at what is referred to as a transition or shift from the conventional waste hierarchy (see section 1.1 of this Paper). In essence, this shift aims at converting the waste pyramid in such a way that the emphasis moves from landfilling (end of pipe solution) to the earlier stages of alternatives such as separation at source, recycling and composting.

Although there is a wide range of drivers behind this transition, desk research shows that in the South African context, there are two drivers that stand out in addition to the environmental and job creation benefits that come with the generation of less waste, early stage treatment of waste and more efficient manners of waste disposal:

- **Extension of the lifetime of existing landfills**: Most of the landfills in South Africa were originally established outside of the urbanised areas. However, with the expansion of urban centres, sites are now located close to populated areas. In addition to potential health concerns, this also means that once the landfill is full, spatial expansion is impossible and a new site has to be identified outside of urban areas resulting in longer distances over which the waste has to be transported thereby increasing the waste transport cost. For this reason, and more, municipalities focus on extending the life of a landfill by reducing the waste volume going into the landfill. In this way, the remaining space available on the landfill site (referred to as the 'landfill airspace') is filled up at a lower rate and therefore the site can remain in operation for a longer period of time.
- **Reduction of waste management costs**: The costs associated with the collection, treatment and disposal of waste exceed the revenue generated for waste levies and tipping fees, etc. This is even more so, the case when the cost of site rehabilitation after the closure of a landfill site is taken into account. For this reason, focus on having less waste in the overall waste process would reduce the overall costs and pressure on the municipal budget.

To develop a clearer understanding of the current status quo within the South African waste sector and to identify if there is a correlation between international trends and the developments within the South African waste sector, a desk study was conducted to identify projects within the domestic waste sector.

The study identified 23 projects across the country, which contribute to the transition as outlined in the Executive Summary of this Paper. Annex 1 provides more detail on the identified projects. The projects were allocated to the different categories of the waste hierarchy applying the following definitions:

- **Source reduction**: Avoidance of waste generation (e.g. ecological design, resource efficient production and re-use after repair) or the re-use of recovered components and/or whole products (e.g. re-fillable bottles).
- **Recycling**: Waste converted into products, materials and feedstock for the original or other purposes (e.g. tyres as building material).
- **Energy recovery**: Waste to energy processes (e.g. bio-digestion, landfill gas to energy, gasification, pyrolysis and heat co-generation with incineration).
- **Disposal**: Disposal without energy recovery (e.g. landfilling without; landfill gas destruction and/or incineration without co-generated heat).

Table 2 provides an overview of the identified projects and where they fit within the different categories of the waste hierarchy.

Table 2: Domestic activities contributing to a transition away from the conventional waste hierarchy dominated by disposal

#	Waste hierarchy categories	Public	Private	Public/Private[4]	Total
1	Source reduction	2	1	3	**6**
2	Recycling	1	3	0	**4**
3	Energy recovery	1	5	5	**11**
4	Disposal	0	1	1	**2**
Total:		**4**	**10**	**9**	**23**

Both projects that were identified within the disposal category of the waste hierarchy consisted of the destruction of landfill gas via flaring and therefore don't really change the current status-quo since they only convert one type of waste (i.e. landfill gas) into and other type of waste (i.e. CO_2 after combustion). Table 2 also shows that the majority of the project activities fall within the energy recovery category. When looking at these projects in more detail it is evident that almost all of them are so called 'landfill gas to energy' projects. These projects utilise the methane gas that is generated by the organic fraction of the waste stored in the landfill as a fuel to generate electricity.

Although difficult to distinguish as the only rationale, it is relevant to consider that these projects are in many cases funded from the expected revenue from the sale of CERs under the Clean Development Mechanism.

[4]* Collaborations between Public and Private sector including formal and less formal PPPs.

Some of these projects are implemented by the municipality itself, but the majority is developed by private companies in collaboration with the municipality including formal and less formal (PPPs). The next section of this report provides a case study of the largest landfill gas to energy project in South Africa, followed by an assessment of the institutional constraints as well as the financial and fiscal constraints.

2.1.1 Case study - eThekwini's Bisasar Road landfill site

Bisasar Road is Africa's largest landfill site, and one of the only three landfill sites in eThekwini currently in operation. It was opened for business in 1980 and receives 3 000 to 5 000 tonnes of waste daily on top of the 19 million cubic metres of waste already deposited in the landfill. Durban Solid Waste (DSW) is the municipal agency responsible for the management and operation of multiple landfills in the Durban metropolitan area including the Bisasar Road landfill. DSW commissions the development of a landfill gas to energy project at the Bisasar Road landfill. The project contributes to the Green Economy in two ways:

- **Methane destruction**: The project captures and destroys the methane (CH_4) released by the microbial activity within the landfill and thus preventing the emission of the potent Greenhouse Gas (GHG) methane into the atmosphere, which contributes to climate change;
- **Renewable electricity generation**: The methane is destroyed by using the methane as a fuel, which is combusted in a set of gas engines. The energy generated by these engines is converted into electricity and exported to the eThekwini power grid and thereby replaces the emissions from coal based electricity (mainly CO_2) with renewable electricity within the South Africa electricity grid.

To capture methane, wells were drilled into the landfill. The wells are connected by pipes to a central collection point where the gas is fed into a spark ignition engine that drives a generator generating electricity and linked to the Durban municipal grid. The project claims two climate benefits: it prevents the release of methane, which is a GHG that is 21 times more potent than carbon dioxide and it generates electricity, which supposedly offsets coal emissions from the electricity these industries would have normally used. However, the climate benefits, if any, are offset by increased emissions in the developed countries which buy the carbon credits generated.

The project consists of an enhanced collection of landfill gas at the Bisasar Road landfill site of the municipality of Durban and the use of the recovered gas to produce electricity. The produced electricity will be fed into the municipal grid and replace electricity that the municipal electric company is currently buying from other suppliers. The project involves the installation of spark ignition engine generators (Jenbacher type 320) to generate electricity. At present 7MW of capacity has been installed, and is operational. The gas fired engines have a conservatively projected useful life of 10 years; the engines may have to be replaced at around this time to permit a continuation of the commercial operations of the electricity generation activity. Over the course of the initial seven-year crediting period, an estimated CO_2 reduction of 342,705 tonnes per annum is predicted.

This project was developed and implemented successfully as eThekwini was able to manage some critical elements. By means of interviews with key stakeholders, the key success factors including requirements around regulations, institutional arrangements, financial/fiscal impact, of the case have been assessed.

Internally the eThekwini municipality defined the following seven success factors:

- Political will.
- Executive willingness.
- Internal project champion.
- Financial capacity and ability to raise further project finance as required.
- Engineered landfills.[5]
- Technically proficient project management team.
- Legally robust interpretation of the MFMA.

The main hindrance quoted by municipalities towards applying PPP models required when collaborating with the private sector, lies in the application of the MFMA. However, this does not apply in this because. The Bisasar Road project commenced before the 2005 amendment to the MFMA)

3. Dealing with Financial and Fiscal Constraints

A look at the eThekwini's Bisasar Road landfill site Case Study as well as the overview of the projects within the transition pathway, indicate that a range of activities dominated by landfill gas to energy projects is already underway. However, it is unclear how the financial structure underlying these activities has been designed and is panning out. To be able to assess the potential for replication of these initiatives, it is important to take into account financial implications of such projects and the regulatory considerations from a financial perspective behind potential projects. The remainder of this chapter looks at these components.

3.1 Financial implications

Due to the confidential nature of financial information, it is close to impossible to obtain detailed insight into the true financial implications of any project within the transition pathway from a capital expenditure, operating expenditure and revenue perspective. This limits the ability to identify the financial implications for a city when entering into such a project. However, it is also important to consider that each project is unique and therefore generic financial information has limited value when deciding to go ahead with a specific project or not.

As a result, there are some financial trends that can be distinguished both globally and domestically. The three basic elements of a business case being the capital expenditure (CAPEX), operating expenditure (OPEX) and revenue, it is apparent that almost all projects result in an initial investment in equipment and/or infrastructure. Over time, this has to be paid back via a reduction in OPEX and or additional revenue. The

[5] Engineered landfills designed from the start for professional waste management fully compliant with environmental regulations and hence, not being upgraded old waste dumps.

diagram on the next page tries to graphically reflect the financial implication of the implementation of a project within the transition pathway in a simplified manner.

Figure 4: Financial dynamics of the investment in and implementation of a green waste management project.

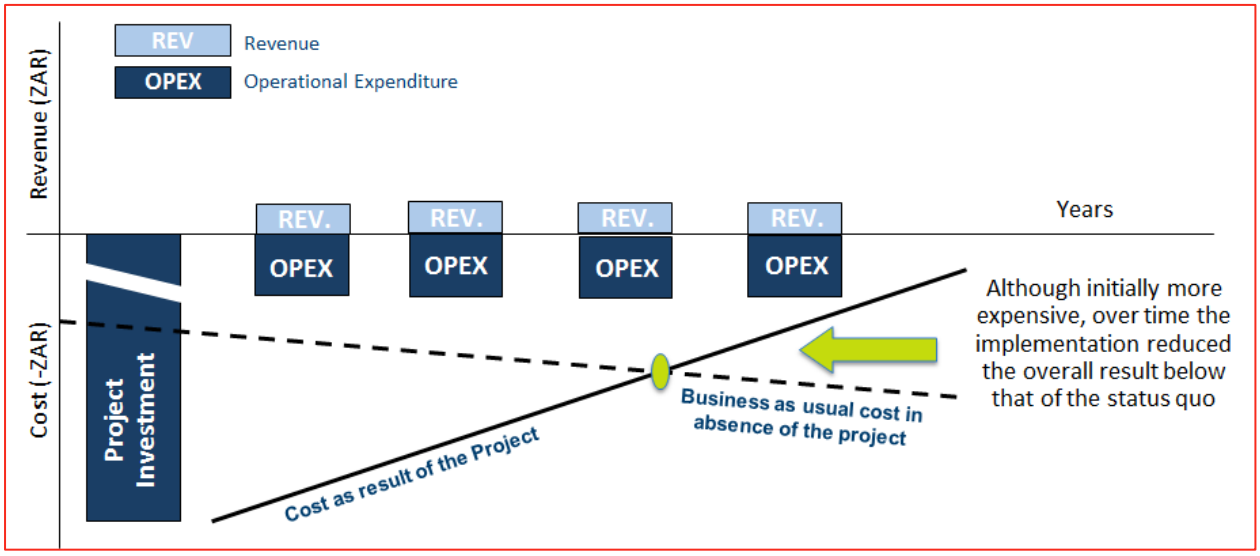


Figure 4 shows that in most cases the overall costs will increase before they decrease and become less costly than before the implementation of the project or in some cases profitable. However, Figure 4 is only a simplification of the financial dynamics of a project. The feasibility, timing, source of funds for implementation of a project depends on the financial prioritisation within a city.

It is important to take into account that the global pattern indicates that projects implemented towards greener waste management practices are most likely to be more costly than continuing with the current waste management practice. It is therefore critical that project opportunities are assessed on a case-by-case basis and only those with clear economic feasibility assisted or not assisted by additional cost recovery mechanisms are executed.

Local practice indicates that projects are frequently developed as PPPs as well as by the municipality itself. Due to, among others, their innovative and non-main stream application, these projects encounter a range of barriers that can be addressed. However, in most cases there are lengthy implementation timeframes. Nonetheless, both types of approaches (i.e. PPPs and internally by the municipality) have been implemented successfully. Unfortunately, it was not possible to assess or compare the different projects on detailed and equal terms as to the financial implications for the relevant municipalities.

3.2 Financial considerations from a regulatory perspective

Following the international trends, municipalities are required to develop an across-the-board waste management service, in line with the Waste Act 2008 and the National Waste Management Strategy. Moreover, municipalities must operate in compliance with the MFMA Act 2003, Act No. 56 of 2003, which aims to modernise budget and financial management practices in municipalities in order to maximise the capacity of municipalities to deliver services to all their residents, customers and users. It also aims to put in place a sound financial governance framework, by clarifying and separating the roles and responsibilities of

the executive mayor or committee, non-executive councillors and officials. The Act empowers the mayor (or executive committee) to provide political leadership by taking responsibility for policy and outcomes, and holds the municipal manager and other senior managers responsible for implementation and outputs. Non-executive councillors are empowered to play a key policy-approval and monitoring role through the municipal council.

The Act is required by the Constitution, which obligates all three spheres of government to be transparent about their budgets and financial affairs. The MFMA must be read together with three other critical pieces of legislation: the Municipal Structures Act, the Municipal Systems Act and the Property Rates Act. All four of these Acts have been designed to give effect to the 1998 White Paper on Local Government, which aims to transform municipalities to become more participatory, transparent and accountable.

Although reasonable in nature, the MFMA in this case is not well aligned with a PPP structure, which is the most commonly used structure applied by South African municipalities when developing a landfill gas to energy project. This was further enhanced by the revision of the MFMA in 2005 which provides more stringent guidance on how municipalities should conduct their supply chain management, general conditions of contract and municipal bidding documents.

Although variations exist, the basic design of a landfill gas to energy PPP project contains the following elements:

1. The municipality sells the landfills gas to the private partner for a period of time (e.g. 20 years).
2. The private partner carries the costs of the construction and operation of the landfill gas to energy project (e.g. wells, piping, flare, genets, etc.) over the same period.
3. The private partner carries the costs of the registration, monitoring, verification and commercialisation of the climate change mitigation benefits of the project (e.g. CDM registration, M&V and sale of CERs).
4. The municipality buys the electricity generated by the landfill gas to energy project from the private partner and shares in the revenue generated from the sale of the climate change mitigation benefits.

The complexity of this structure in relation to the MFMA lies in the fact that the municipality sells one of its assets (in this case the landfill gas) and receives revenue (from the sale of electricity and climate change mitigation benefits) over an extended period of time (e.g. 20 years to allow for sufficient time to realise a return on investment against the costs incurred by the private partner). However, the MFMA mainly looks at the process followed when procuring goods and services and sets requirements on the process followed such as a limited timeframe not exceeding three years and the requirement that the goods or services are procured via a competitive tender process from which the most costs effective bidder is awarded.

As part of this desktop study, ways in which municipalities have addressed differences between the MFMA and the implementation of a PPP structure within the waste sector have been explored. Such ways can be grouped into three categories:

1. **Alternative project structure**: Some municipalities have overcome MFMA barriers by adopting a different project structure. For example, the project is developed completely by the municipality itself

and all the goods and services required are procured by the municipality following the 'normal' MFMA rules and guidelines.

2. **MFMA exemption**: Some municipalities approached the relevant national government department (in most cases National Treasury) and provided details on the project's design in an open and transparent manner and, based on this explanation, requested an exemption of the MFMA requirements for the specific project.
3. **Principle MFMA compliance**: Other municipalities took the view that although the project structure would not be strictly compliant with the letter of the MFMA, the municipality would act within the 'spirit' of the MFMA by being transparent and accountable on all aspects of the project with regard to the expenditure of public funds.

Although different in nature, all solutions seem to have some drawbacks. For example, option one requires that the municipality has the financial resources to carry the project costs by itself, whereas option three requires the mayor (or executive committee) to be willing to take the risk of being challenged on MFMA compliance issues and potentially not being able to explain the choices made in a satisfactory manner. An additional concern that needs to be taken into account when a municipality implements the project internally is that, this requires strong technical and project management skills within the municipality.

4. Institutional Requirements

Conducting an assessment of the institutional requirements is necessary to drive innovation within the waste sector in a way that contributes to the development of the green economy of a city. Therefore, it is important to define what constitutes a successful project of this nature.

This study takes into account the following project success factors:

- Resource management impact: whereby the implementation of the project results in the more sustainable use of natural resources both up and downstream of the project activity.
- Pollution impact: whereby the pollution resulting from the waste management process is reduced by the implementation of the project or at a minimum not increased as a result of the project.
- Climate change impact: whereby the project reduces the contribution to climate change of (in most cases the original landfilling practice) by mitigating the release of Green House Gasses (GHGs) into the atmosphere.
- Economic feasibility: whereby the project itself is economically feasible from a cost revenue perspective or, at a minimum, reduces the costs for the municipality in relation to the costs incurred in the absence of the project.
- Job creation: whereby the project should take cognizance of the impacts on existing jobs and where possible to implementation and operation should lead to the creation of additional jobs.

The above defined project success factors are reflected upon in Table 3 below from an institutional capacity as to what is required in terms of structure, skills and budgets to manage the transition.

Table 3 – Success factors specific to institutional requirements in terms of structure, skills and budget.

Success factor	Structure	Skills	Budget
Resource management impact	Requires an institutional structure that is able to manage and monitor the impacts of the project upstream from its waste management responsibilities.	Externally focused management and communications skills.	Depending on the details of the projects the budget expenditure could be zero or small.
Pollution impact	Requires an institutional structure that has the ability to independently assess and monitor the realization of the pollution impact of the project.	Advanced pollution monitoring and management skills.	The costs related to this success factor mainly lie around the procurement and operation of monitoring equipment or the acquisition of monitoring data from external sources.
Climate change impact	The organization ability to assess, monitor and verify the climate change impact and the legal and commercial structures to contract and commercialize the climate change benefit.	Legal and commercial skills.	Potentially the positive climate change benefits can result in an additional revenue stream to the project. However this revenue stream does require upfront expenditure.
Economic feasibility	Requires an institutional structure (independent of the legal design of the project; PPP, in-house, etc.) which is able to objectively develop business cases for a range of waste management projects and make multi variable implementation decisions.	Financial modelling skills, legal skills and commercial skills.	These costs mainly consist of maintaining internal or acquiring external financial modelling and technology selection skills. It is important to consider that these costs might be material but are necessary to prevent unfeasible investments at much higher costs.
Job creation	Requires an institutional structure that has the ability to assess the job creation potential of a project and can facilitate the job creation process via selection and training.	Human resources and training skills.	The costs related to training can be substantial dependent on the project type which could either result in training large numbers of staff or a more detailed training program for a limited number of staff.

Resource Management Impact

The larger the resource management impact of a project the further outside of the traditional waste management sphere of a municipality the activity will reach. This means that by the very nature of such a project the institutional skills required lie more in the field of third party management (e.g. guiding a marketing agency trough the public outreached process of the project) and external communication (e.g. driving behavioural change within the general public).

Pollution Impact

By its very nature the waste management process has numerous elements contained in it that lead to the increase of pollution (e.g. drink water contamination from a landfills site). It is therefore critical that a project is assessed from it pollution impact from start to finish to prevent perverse impacts (e.g. less or no drink water pollution due the use of a new landfill site with a closed bottom liner but additional transport pollution due to the more distant locations of the new landfill site). It is therefore critical that a municipality has the institutional skills to assess the pollution impact of a project and the ability to monitor the pollution impact over the lifetime of the project.

Climate Change Impact

Although the emission of GHGs causing climate change is also a form of pollution, assessing and monitoring GHG emissions requires specific skills. As there is a wide range of instruments which have been put in place to monitor and support the mitigation of GHGs in developing countries such as South Africa, GHG specific M&V, financing schemes and emission trade evolved to sophisticated professional areas of expertise. For this reason the institutional requirements placed on a municipality are wider than those for pollution impacts and also include legal and commercial skills which would allow the municipality to receive material revenues from waste management projects that mitigate the emission of GHGs.

Economic Feasibility

In most cases (both globally and locally) the waste management process results in more costs than revenue from a municipality perspective although it is feasible to implement projects that reduce the cost burden for municipalities and potentially result in enough revenue generation to be economically feasible in themselves. To be able to determine the, in some cases, material costs versus benefits of a project, a municipality must possess material financial modelling, legal and commercial skills to be able to correctly asses the economic feasibility of its potential projects within the waste management sector, and make sound choices and set priorities accordingly.

As indicated in the Chapter one, and also applicable to the South African situation, international funding and/or private sector financing may be required to invest in the required organisational and capital infrastructure in addition to cost recovery and environmental law enforcement in order to make initiatives truly sustainable.

Fortunately, there is a wide range of instruments available to unlock green international and national funds. One of these instruments is a so-called Nationally Appropriate Mitigation Action (NAMA), a plan encompassing nationally approved activities that should lead to verifiable GHG emission reductions within the country. By means of a NAMA one can tap into the Green Climate Fund, one of the main funds set aside by the industrialized world to finance green mitigation initiatives in developing countries. A similar national instrument is the Green Fund. A potential innovative new financing instrument could be selling emission offsets to be used under the South African carbon tax envisaged to be introduced by January 2016.

Developing skills to appropriately structure the mitigation and financial side of projects hand in hand, will assist in tapping into this type of funding. See also the sub-section '*Climate Change Impact'* above.

Job Creation

Due to the high levels of unemployment across South Africa, all spheres of government have a natural focus on the creation of sustainable jobs within their operations. This is also the case when implementing waste management projects. It is important to note that some of the waste management projects studied as part of this paper by their nature are more capital than labour intensive and therefore the job creation potential is limited. However in the cases where projects are labour intensive it is important that the municipality has sufficient human resources and training skills in house to successfully realise the job creation potential of a project and to create a platform from which these types of projects can be rolled out and replicated.

Within the collection and separation of waste there is ample opportunity to create jobs. In line with international recommendations, municipalities should apply a pro-poor approach facilitating in the professionalization and mechanisation of the informal waste collection sector whereby cost effectiveness is guarded at the same time to keep job creation initiatives sustainable.

5. Conclusion and Recommendations

Although acknowledging the promises of a green economy, the transition towards sustainable MSW management practices demands substantial engagement and preparation in both the public and private sector. In order to reap the rewards of a green economic transition in the waste sector, substantial investment is required in the soft and hard infrastructure. Moreover, the right implementation models need to be applied, including cost recovery and law enforcement precautions to ensure the sustainability of initiatives.

When the aforementioned conditions are met, international, and to some extent, domestic examples show that waste management cost to the municipality can be reduced in the long run and that green waste management practices can make a positive contribution to the green economy. The Paper has reviewed several requirements to reach this goal by taking both an international and domestic perspective. Unfortunately it was not possible to assess or compare the different successfully implemented projects on a detailed and equal basis as to the financial implications for the relevant municipalities.

In summary, municipalities should address the following key requirement areas:

- Building internal organisational capacity/skills in line with novel green waste management requirements (e.g. PPPs, technology, performance contracting, business modelling, GHG emissions mitigation).
- Request national government to remove regulatory restrictions in the MFMA enabling municipalities to deal with longer term contracts and revenue generating activities as well as to operate as a business partner in waste alongside or in collaboration with the private sector.
- Development of project plans and financially viable implementation models including sound cost recovery strategies and MRV procedures.
- Unlocking funds for investment in green infrastructure through private sector involvement as well as by tapping into international/domestic green funds or financing mechanisms.

- Build external skills (e.g. informal waste sectors) and sensitise stakeholders to maximise the environmental and economic impact.

Waste management practices in South Africa are currently still predominantly governed by landfilling, which due to a lack of suitable space needs to be faded out in time. Therefore, the country is still at the start of a transition towards green waste management, which if prepared well, will provide ample opportunity to contribute both to the economy and environment, making cities a better place to live and do business in.

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Annex 1 – Details of Domestic Waste Management Project

#	Project name (location)	Project description	Waste pyramid category	Source
1	Waste Minimisation Clubs (WMC), (National).	Consisting of groups of companies that work together to reduce waste and save money. Clubs have so far been formed in the industrial and commercial sectors.	Source reduction	http://www1.uneca.org/Portals/sdra/sdra3/chap4.pdf
2	EnviroServ Chloorkop landfill gas recovery project (Ekurhuleni).	The project aims at the recovery and utilisation of methane gas from EnviroServ Chloorkop landfill.	Disposal	http://cdm.unfccc.int/Projects/DB/DNV-CUK1171370021.04/view
3	Ekurhuleni landfill gas recovery project (Ekurhuleni).	The project aims to capture landfill gas from landfill sites around Ekurhuleni Metropolitan Municipality.	Disposal	http://www.envitech.co.za/other.php?pageID=16
4	Alton Landfill gas to electricity project (Richards Bay).	The project aims to generate electricity from landfill gas.	Energy recovery	http://cdm.unfccc.int/Projects/DB/DNV-CUK1241160782.32/view
5	The DWS Anaerobic Digestion (AD) Waste Treatment to Energy Project. (eThekwini).	The objective of the project is to reduce waste disposal volumes to landfill by treatment of food and organic wastes.	Energy recovery	https://www.dontwaste.co.za/Default.aspx
6	Bronkhorstspruit Biogas Plant (Bronkhorstspruit, Tshwane Metropolitan area).	The objective of the project is to generate electricity using biogas produced from beef cattle manure, chicken litter and waste from food industry.	Energy recovery	http://bio2watt.com/projects
7	Cape Dairy Biogas Plant (Malmesbury, Western Cape).	The objective of the project is to generate electricity using biogas produced from beef cattle manure and a mix of other waste streams available within the surrounding region.	Energy recovery	http://bio2watt.com/projects
8	Industrial Bio Coal Project (Stutterheim, Eastern Cape).	The project proposes to convert organic waste into Bio Coal, which will be used as; a direct replacement for A Grade Steam Coal industry and public institutions.	Recycling	http://biocoalafrica.com/
9	Middelburg Waste Management Project (Middleburg).	The project specialises in waste management, namely the recovery, repair, recycling and re-use of waste.	Recycling	http://www.openafrica.org/participant/middelburg-waste-management-project

10	Community Based Refuse Removal Scheme (Khayelitsha).	Waste Removal and reduction Project titled the Billy Hattingh "Community Based Refuse Removal Scheme".	Source reduction	http://www.municipalservicesproject.org/sites/municipalservicesproject.org/files/publications/
11	Oasis Recycling And Waste Management Project (Claremont, Western Cape).	special events clean ups, educational programmes (green bag campaign), recycling & re-use initiatives	Source reduction	http://impumelelo.org.za/awards-programme/our-winners/oasis-recycling-and-waste-management-project
12	E-waste recycling project (Tshwane).	The project involves the dismantling of old and unused computers and other electronic equipment for recycling purposes.	Recycling	http://www.ptapathways.co.za/Ewaste.html
13	Durban Solid Waste: Waste Collection Programme (eThekwini).	The project facilitates the extension of their waste management and refuse collection services (e.g. household refuse collection, street cleaning) to the newly incorporated areas.	Source reduction	http://impumelelo.org.za/awards-programme/our-winners/durban-solid-waste-waste-collection-programme-1
14	Solid Waste Network (SWN) (Cape Town).	Provides access to markets for informal waste pickers for the sale of plastic, cardboard and glass recyclables to an intermediary to the recycling industry.	Recycling	http://sasdialliance.org.za/projects/solid-waste-network/
15	Robinson Deep landfill gas to energy project (Springfield).	The project converts landfill gas to electricity.	Energy recovery	http://www.engineeringnews.co.za/article/johannesburg-landfill-gas-to-energy-project-underway-2011-09-30
16	Goudkoppies landfill gas to energy project (Devland).	The project converts landfill gas to electricity.	Energy recovery	http://www.infrastructurene.ws/2014/01/24/joburg-turns-landfill-gas-into-electricity/;
17	Ennerdale landfill gas to energy project (Lawley).	The project converts landfill gas to electricity.	Energy recovery	http://www.engineeringnews.co.za/article/johannesburg-landfill-gas-to-energy-project-underway-2011-09-30
18	Marie Louise landfill gas to energy project (Dobsonville).	The project converts landfill gas to electricity.	Energy recovery	http://www.infrastructurene.ws/2014/01/24/joburg-turns-landfill-gas-into-electricity/;
19	Pikitup gas-to-energy project (Johannesburg).	The project is a sustainable and small-scale solution to waste management from gas.	Energy recovery	http://www.pikitup.co.za/jit_default_1239.html
20	Bluebag project (Lonehill).	This is a recycling-at-source project	Source reduction	http://www.lonehill.info/EN/Content/ViewArticle/A/PikitUp+Recycling+in+Lonehill
21	Fruit Waste biogas to electricity and heat (Bapsfontein).	This project uses waste fruit biogas to produce electricity and heat	Energy recovery	http://eepafrica.org/wp-content/uploads/proejct_list_for-web_FEB2014.pdf
22	Production of cellulosic ethanol	This project uses paper sludge and waste paper to produce	Energy	http://www.engineeringnews.co.za/article/biofuels-

	from paper sludge and waste paper (Tongaat).	ethanol.	recovery	technology-firm-seeks-partners-for-cellulosic-ethanol-plants-2010-07-02
23	Separation at source (Johannesburg).	The project aims at expanding the practice of setting aside post-consumer materials and household goods so that they do not enter the mixed waste streams.	Source reduction	http://www.pikitup.co.za/