WASTEFLAGSHIP PROGRAMME- THE DIVERSION OF MUNICIPAL SOLID WASTE AWAY FROM LANDFILLS IN SIX SOUTH AFRICAN MUNICIPALITIES

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ABSTRACT

The Government of South Africa, in partnership with the German Government, has embarked upon the Waste Management Near-Term Priority Flagship Programme, which seeks to identify areas for strategic interventions that advance the waste diversion/ minimization objectives of both the National Climate Change Response Policy and the National Waste Management Strategy (2011).

Diversion of organic waste (including green waste) away from landfills is one effective approach to mitigating the waste sectors' greenhouse gas (GHG) emissions. Other alternatives also exist such as recycling of packaging waste, i.e. paper, plastics, glass and other such recyclable materials. Recycling goes a long way in mitigating climate change due to the preservation of natural resources. Proper implementation of the waste hierarchy supports climate change response, waste management and sustainable development simultaneously. This project offers an opportunity to make a step change in the development of Integrated Solid Waste Management (ISWM) practices in the partner municipalities.

There is a need to scale up existing climate change response programmes but to also consider introducing alternative waste management options or combination of technologies to maximise the benefits from improved waste management systems, thus further mitigating climate change.

The waste sector in South Africa is estimated to be worth R15.3 billion per annum (DST, 2013). However, the resulting market potential is currently not being used: the waste sector is characterized by approximately 90% of all waste being disposed of at landfills (Lazarus et al, 1997). The resource value of the waste is estimated to be R25.2 billion per annum (DST, 2014).

The challenge with moving away from simply collection of waste to disposal is the funding of infrastructure for treatment of waste especially organic waste. Once the waste treatment options for the diversion of waste have been identified, the next steps would be to seek and submit funding proposals to funding institutions. The proposal would need to fulfil the funding criteria of the specific funding institutions.

1. INTRODUCTION

There is significant potential for the waste sector to mitigate it's GHG emissions. However, this requires a paradigm shift with respect to the waste management practices currently in place, such as landfilling. Alternative waste treatment practices and technologies provide an alternative to the landfilling of waste. These technologies/practices convert waste to a valuable resource through one or a combination of mechanical, biological and thermal processes (DEA, 2015).

The waste hierarchy, aims to minimize waste, by promoting the avoidance, reduction, reuse, recycling, and recovery (energy etc.) of waste, disposal is viewed as a last resort. The beneficiation of waste and recognition of waste as a valuable resource is a key element of the waste management flagship programme. Similarly, the optimization of sustainability co-benefits associated with waste diversion practices and technologies are focal points, particularly job creation.

The purpose of the pre-feasibility study was to identify waste diversion intervention strategies to be included in the Integrated Waste Management Strategies and Integrated Development Plans of the 6 selected municipalities. Scenarios were formulated and analysed per municipality to assess technical, institutional,

financial, legislative and environmental aspects. Each municipality then selected suitable projects from the scenarios for which business and implementation plans were developed.

In order to effectively transform the waste sector, involvement from both the public and private sector is crucial in the implementation of waste projects and programmes, to contribute towards national emission reduction targets.

Ideally a programme will be developed on the basis of the outcomes of the waste management flagship programme pre-feasibility study.

2. METHODOLOGY

The sub-sections below are key elements of the pre-feasibility study which formulated the approach and main aspects of the Project:

2.1 Methodology and workplan
2.2 Stages of the project
2.3 Decision making tool (scenario formulation)
2.4 Climate change (emissions reduction)
2.5 Criteria identified that offers greater opportunity for beneficiation
2.6 Lessons Learnt (to allow future projects to benefit)

Other elements of the Project were to identify major and minor risks and mitigation measures. These are project specific and are available from the author.

2.1 Methodology and Work Plan

The following graphic, Figure 1, illustrates the broad methodology used in executing the Project (stages, steps, approach, sequence of events.)

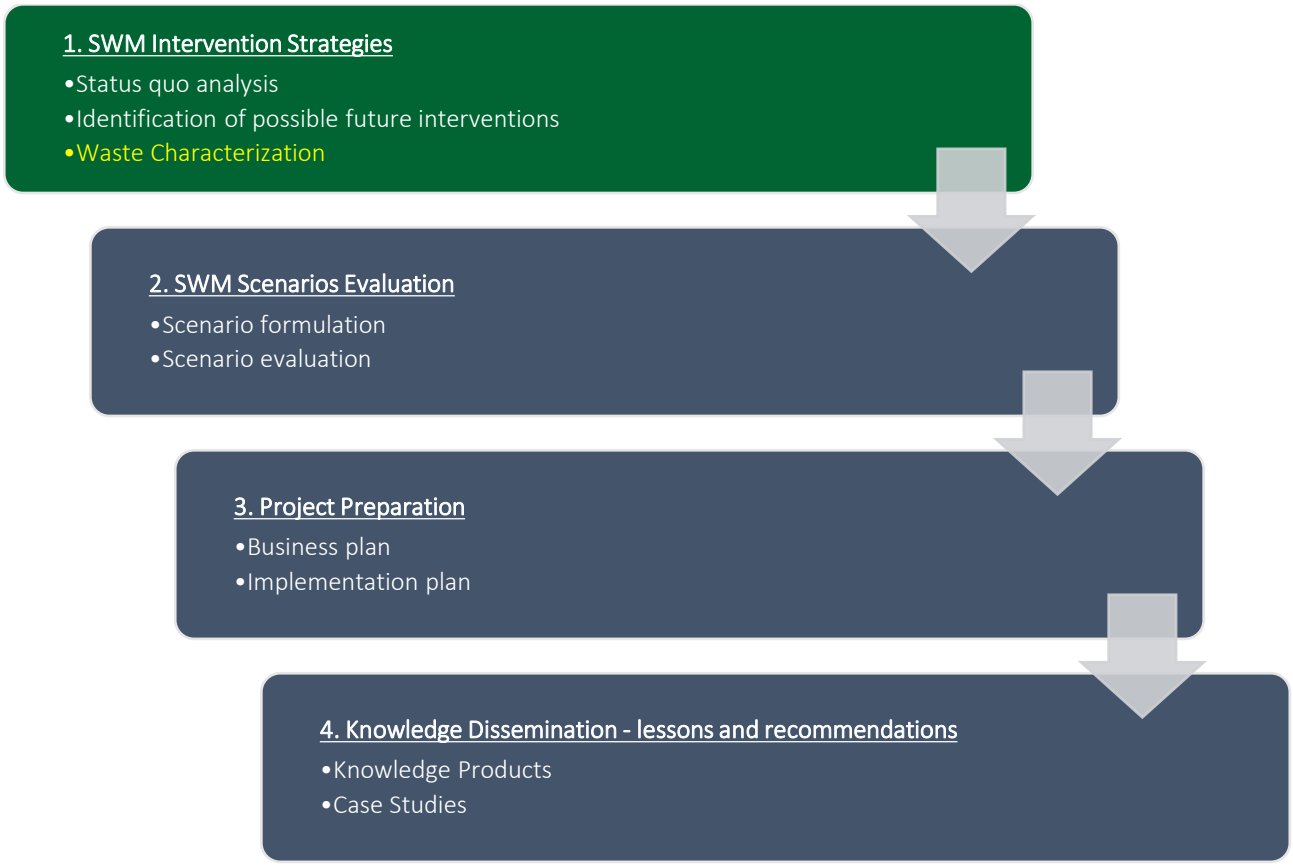

Figure 1: Methodology and Approach

2.2 Stages of the project

A crucial element of the project was the extensive rigorous stakeholder engagements, at both local level, and national level, to allow full debate, knowledge sharing and to agree upon criteria that would be essential to any sustainable project.

Key Stages and activities of the project, in brief, were:

1. Project inception workshop;
2. Field investigation, local municipal staff and team introduction and knowledge sharing;
3. Status quo analysis (included IDP, IWMP review);
4. Waste characterisation investigation (site work and literature);
5. Project review workshop (intervention identification);
6. Further on-site (local level) debate and engagement on possible scenarios;
7. Additional site investigatory work;
8. Scenario formulation and evaluation;
9. Further on-site (local level) debate and engagement on possible scenarios and projects to be selected;
10. Project Team engagement on legislative (includes procurement) and funding mechanisms for business and implementation plan development;
11. Preferred Project Plan (business and implementation plans)
12. Lessons Learnt review
13. Over-arching preferred project workshop and engagement.
14. Way Forward.

2.3 Decision Making Tool

A multi-step method was used to formulate Scenarios per municipality and aide decision making. These were:

1. A total of 40 generic interventions were identified and ranked according to the National Waste Management Strategy Hierarchy. A comparison between the interventions using the selected technical, environmental, financial, legal and institutional criteria was done and used to determine a record of “soft interventions” that would be pre-requisites for each intervention to be successful.
2. Three sets of input data were used to determine the total quantity and character of waste. Three main waste streams were focused on, namely: (1) organics – greens, (2) organics – food waste, and (3) packaging waste.
3. After specific waste streams were identified, and the geographic and climate aspects taken into consideration, generic interventions were selected for each municipality. This was done by taking a critical look at the waste stream composition (Sub-section 2.1.2), the output/product requirements and the key driving factors such as affordability, institutional capacity and feasibility amongst others.
4. System interventions were then formulated to address a specific identified waste stream, such as organic food waste, organic greens and packaging. These system interventions also highlight the inter-dependencies between each individual intervention, which is critical.
5. System interventions for all three waste streams were then linked together by the municipal managers and officials, in order to formulate a set of scenarios for the municipality.

One innovative approach was the use of cards (Photo 1) to show SYSTEM intervention approaches, suited to local conditions.

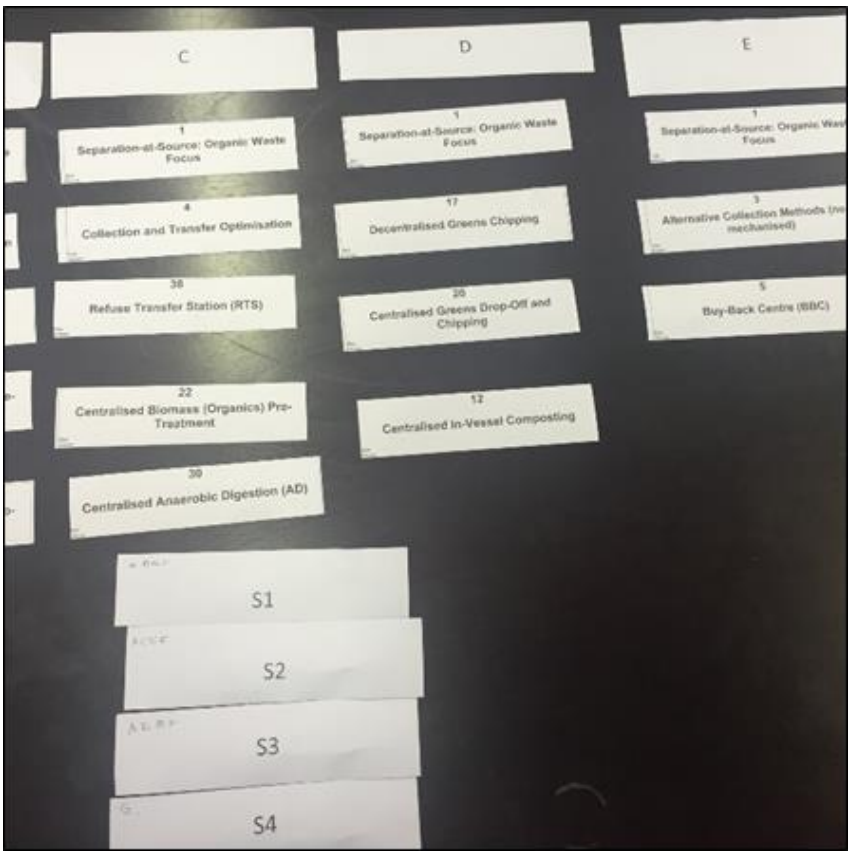

Photo 1: Key cards for decision making

In order to highlight a "preferred" scenario from the five comparative scenario evaluations above, the unique Triple 'A' Consolidated Evaluation Method was used. This method focuses on three key criteria of an AISWM scenario or project, namely: (1) how appropriate it is, (2) whether it is applicable, and (3) if it is affordable.

2.4 Climate change

2.4.1 Scenario analysis: Environmental evaluation

The viability of the scenarios formulated per municipality were evaluated financially, environmentally institutionally and legally.

For this project, greenhouse gas (GHG) reduction was calculated as the difference between the baseline and each scenario's GHG reduction potential. The assessment took into account only the methane generation at the landfills and the mitigation impact resulting from the diversion of waste from the landfill per scenario formulated for the municipalities.

Emission reductions resulting from the replacement of virgin materials with recyclable materials or from the generation of energy from waste, where waste is considered as a renewable energy resource, was not considered in the assessment. Likewise, process emissions from the different treatment options were also not dealt with, due to insufficient data.

The IPCC Waste Model was used to compare previous evaluations with current evaluations as well as to align with international best practice. The IPCC Waste Model has been shown to provide 'fair results compared to field measurements' in other studies (e.g. Wangyao *et al*., 2010), taking into account the climatic conditions associated with the area as well as the variation of degradation rates between seasons.

"First Order Decay" method, as was used in the Status Quo Report. This method takes into consideration long-term methane generated at the landfill, using the following equations (Pipatti *et al*., 2006):

$$CH_4 \text{ generated}_y = DDOC_m \text{ decomp}_y \times F \times 16/12$$

The project deliverables contain the outcomes of the values and the default values used. An example of such analysis is found below in the Figure. Figure 2, represents GHG emissions over an 80-year period for the possible scenarios developed per municipality.

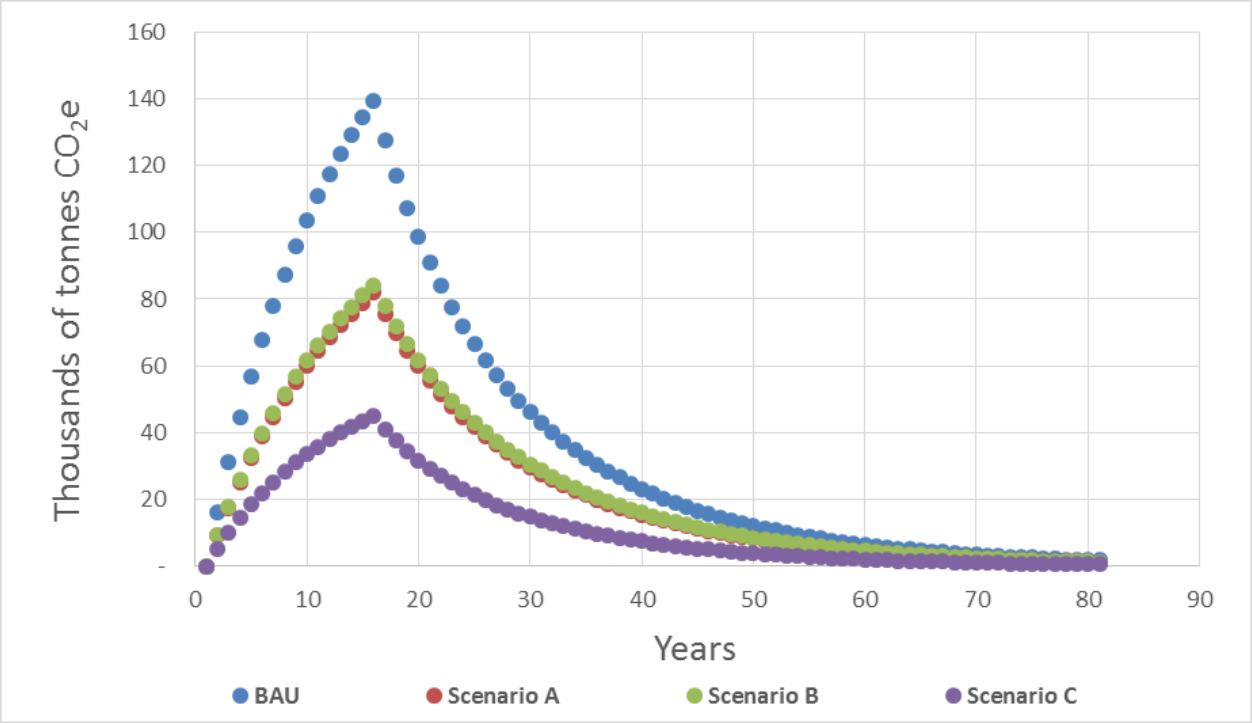

Figure 2: Tonnes CO_2e generated over 80-year period at landfill

Another key element for analysis is the comparative analysis between financial modelling outcomes (Net Present Value - NPV) and the emission avoidance figures. An example of such analysis is shown below

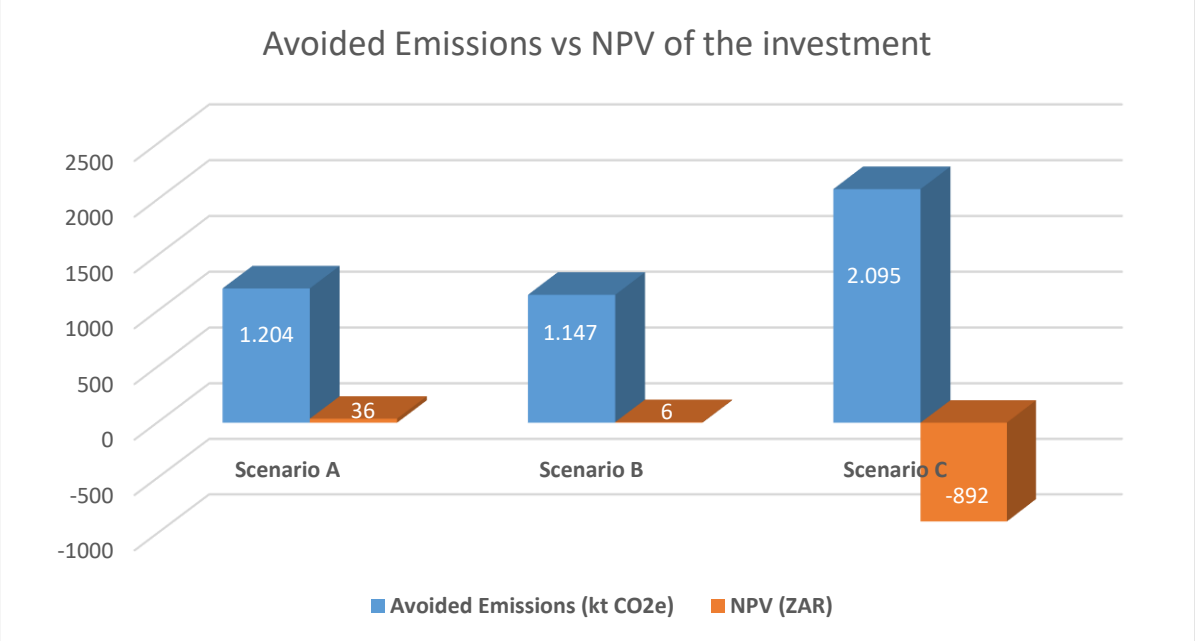

Figure 3. Avoided emissions vs NPV of the investment

2.5 Criteria identified that offers greater opportunity for beneficiation

After extensive debate, certain aspects were identified as items of major importance, to allow greater opportunity for any waste-beneficiation project to achieve sustainability and viability. These criteria can be summarised as follows:

2.5.1 All Preferred Projects will have an effect on the greater waste material system.
2.5.2 Geography of the waste material "catchment area";
2.5.3 Climate;
2.5.4 Social culture of the area;
2.5.5 Industry maturity for selected waste materials as a product (local level, district level, provincial level, national level);
2.5.6 Feedstock (waste) quantum and variability (in quantity);
2.5.7 Feedstock character and variability (in character);
2.5.8 Climate Change mitigation potential;
2.5.9 Emission avoidance potential;
2.5.10 Municipal land;
2.5.11 Existing civil, transportation and electrical infrastructure;
2.5.12 Existing project (to avoid duplication or derailing planning for viable projects);
2.5.13 Budget and effects on gate fee for any potential projects;
2.5.14 Staffing and institutional arrangements;
2.5.15 Procurement processes;
2.5.16 Regulatory framework;
2.5.17 Capital and operating expenses of relevant departments;
2.5.18 Effects on tariffs and rates for any changes;
2.5.19 Other (contained in Project Reports).

2.6 Lessons Learnt

During the project, a key element was to note lessons that could be learnt from the Project Team, to allow future such projects to benefit.

Some of the lessons can be seen below.

Table 1: A few key Lessons Learnt

Topic	**Lesson Learnt**
Learnership	Learning opportunities must be identified in collaboration with universities, to align project with the syllabus timewise.
Empowerment	Interns and youth employed by the municipalities must preferably be assigned to the project to maximise the capacity building benefit for the individual and the municipality
Council approval	TOR should take into account Municipal approval processes, such as reporting, presentation to Municipal Manager and CFO, ultimately to obtain Council Resolution.
Waste tonnage data	Poor data quality, susceptible to weighbridge operations and the municipalities collecting and reporting on waste quantum accurately. ToR should account for additional time for waste characterizations to allow for a more accurate survey indicative of the seasonal changes.
Bottle necks – legislation	EIA process Waste licence applications Atmospheric emission licence applications Public participation as part of the EIA process
Procurement	Long-term versus short-term contracts need to be demystified and considered a real opportunity for contracts with external parties. Public participation processes are required for contracts longer than 3 years.
Municipal champion/ drivers	Many Municipalities have limited resources to take over the planning and implementation of the project(s) as a representative of the local municipality.
Emission avoidance modelling	No common modelling software appears to exist which is able to encompass all aspects of a solid waste project-intervention.
Emission avoidance modelling	Base data is lacking at a local municipal level.

Topic	Lesson Learnt
Change in institutional matters	Labour issues are an important risk to note.
Consortiums	Bringing a consortium instead of a single consulting team was very beneficial to the project, this is a recommended future approach.
MRV	Lack of base data and use of IPCC model is best suited to the project objectives, but still does not represent the full story of collection, avoidance of raw material use, etc.
Implementation	Identify the gaps between pre-feasibility and implementation that could possibly be added to the ToR.
Market Analysis	Test the market demand for outputs more rigorously, to avoid the development of unviable scenarios.
Stakeholder Engagement	Set aside substantial time for stakeholder engagements, to ensure useful outcomes. The municipalities must be consulted and involved throughout the process to enhance ownership.
Scenario Formulation	Scenarios developed must take into account waste activities within the district that may impact the waste streams of the partner municipalities.

3. CONCLUSION

The above findings are key knowledge sharing elements of the Project, that aid future such Projects and local authorities to identify waste diversion opportunities relating to procurement and legal elements. The next step is the application for funding from the Green Climate Fund (GCF) in order to develop infrastructure which will assist to divert organic waste for mitigation of green-house gas emissions.

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