Converting City Waste into Compost
Pilot Nairobi
(LNV-BO-10-006-115)

Report Inception Mission
March 16 – 21, 2009

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1 Project background and setting

Waste management is a growing problem in the Great Lakes Region in East Africa. The increase in solid waste generation has not been accompanied by an equivalent increase in the capacity of relevant urban authorities to deal with it. As an example the current generation rate of garbage in the city of Nairobi alone is estimated over 2,000 tons per day and consists mostly of wet, partly decomposed biomass with smaller quantities of textile, plastic, paper, glass and metal. The cities face a major challenge in establishing an effective and efficient waste collection system. To date most of the waste is not even collected, and the waste that is collected ends up in very problematic dumpsites such as Dandora in Nairobi. Most of the material recovery for recycling is carried out by scavengers on the waste dump or even before and there is no comprehensive system for segregation at source nor any proper transfer stations to increase material recovery for recycling purposes.

There is a general practice of open burning and unhealthy material recovery practices resulting in hazardous emissions that include dioxins/furans causing serious health problems. Hazardous medical and industrial waste is likewise dumped at such uncontrolled sites. For Nairobi the UNEP commissioned a study of the Dandora dumpsite and the initial findings suggest that there are severe public health and environmental consequences. The study shows that this dumpsite is indeed a serious threat to residents, especially children living nearby as well as city's environment in general. For example, the study found that half of the children tested had concentrations of lead in their blood that exceed internationally accepted levels.

As a result of the said study the Nairobi City Council and Kenya's Ministry of Environment decided to ask UNEP to help develop a new comprehensive waste management system for Nairobi. UNEP is now assisting in the development of an Integrated Solid Waste Management (ISWM) Plan (Project Summary presented in **Appendix 1**). The ISWM plan for Nairobi will look into the development of proper waste collection and disposal. The ISWM aims to reduce waste streams by at least 50% through recycling. The ISWM would consider establishing waste transfer stations where waste will be separated and recycled. The unusable waste left over will then be dumped in a new sanitary landfill that will be managed properly (the Government has announced that it will close the Dandora waste dump site). The ISWM strategy foresees the development of public private partnerships for all elements (collection, separation, recycling and disposal) of the waste.

At the same time, Kenya is facing serious shortages in fertilizers and this has been compounded by the rise in oil and raw material prices which ultimately result in higher fertilizer prices. There is a real danger of eutrophication of all open water in the Great Lakes region if artificial fertilizers are to be applied on a large scale in order uplift the agricultural sector from marginal farming to more productive levels. Meanwhile food production has declined in the recent past with most farmers unable to produce sufficient food hence resulting in food insecurity and malnourishment. Although more than 50% of the waste is organic in nature, and compost would and could improve the poor African soil structures in a very sustainable manner, only very few local composting initiatives (commercial or otherwise) exist to date that uses organic city waste.

UNEP and the Kenya Government are therefore interested to identify the possibilities of setting up a facility that will use organic city waste to produce natural compost. Therefore a project complementary to the UNEP project has been funded by the Dutch Ministry of Agriculture, Nature and Food Quality with the following objectives:

- Explore options for the development of a viable system of collecting, processing, distribution and marketing of organic city waste material for application in (peri-urban) agriculture for major cities in East Africa in general and for Nairobi in particular;
- Formulate development scenario's and policy recommendations for implementation.

Comments by some of the stakeholders suggest that there is an expectation that resource recovery through decentralised, small and medium-scale composting, together with large-scale composting facilities will:

- Produce a useful product with monetary value that would at least partially meet the cost of proper waste management;
- Provide natural, affordable, compost to the agricultural sector rather than the massive introduction of artificial fertilizer that would be associated with a number of environmental concerns (in terms of energy and run-off plus deposits in open water);
- Substantially reduce the waste to be dumped at the landfill site;
- Provide additional employment for the poor (in waste segregation, handling and storage of matters to be recycled or used as fuel, composting, etc.).

A second phase of the project is to validate the methodology for major cities in the Great Lakes Region in terms of volumes of recyclable material and volumes of compost. The full project proposal is presented in **Appendix 2**.

2 Mission objectives and program

In the period March 16 – 21, 2009, the project team made an inception mission to Nairobi. The mission had the following objectives:

- Have a common understanding of the Kenyan and Dutch project partners with respect to the project objectives, the approach and the expected results;
- The project team familiarised with waste management situation and its major players and impressions obtained of potential processors and users of organic waste/compost in the (peri-) urban area of Nairobi;
- Linkages established with the implementation team of the UNEP/CCN project and detailed knowledge obtained about the planned methodology and activities of the project;
- Detailed workplan agreed upon and formulated for 2009, including tasks and responsibilities of project partners and detailed budget breakdown;
- Project workplan tuned with plan of activities of UNEP/CCN project.

The project team consists of the following persons:

- André de Jager (Wageningen UR – LEI); project manager and farming systems expert with focus on smallholder agriculture in East Africa;

- Kor Zwart (Wageningen UR – Alterra); expert in technical aspects of composting and bio-gas;
- Anne Scheinberg (WASTE); expert in waste management;
- Davies Onduru (ETC East Africa); expert smallholder agriculture and composting;
- Paul Kirai (ECM Centre); expert in environmental and waste management
- Joyce Gachugi (ECM Centre); expert in environmental and waste management

Expertise and proposed roles of the various project partners are presented in **Appendix 3.**

A global overview of the mission program is presented in **Appendix 4**. The main activities of the mission program focused on team building of the project team, field visits to get acquainted with the waste management, composting and bio-gas practices in and around Nairobi and link-up with the UNEP/CCN project team.

During the inception mission the proposed Kenyan partner organizations ETC East Africa and ECM Centre were introduced to the Dutch project team and the project objectives. Prior to the mission, limited preparation for field visits could be done, so the field visit program was developed gradually during the mission period. Observations of the field visits and activities during the inception mission are presented in **Appendix 5.** With a more timely preparation, a more comprehensive and targeted program of field visits could have been organised. But overall the implemented program was considered to be appropriate to get acquainted with the project environment.

In between the field visits various project team meetings were held to reflect upon the impressions of the visits, discuss the general project approach and start formulating elements of the workplan. At the end of the mission, tasks for the formulation of the work plan were divided among the team members. The major output of the inception workshop, the workplan, is presented in **Appendix 6**.

3 Linkages with UNEP/CCN project

Consistent with the IETC culture, the current ISWM process is technically focused, with its main investment in sampling waste for its calorific value and moisture content. A review of the methodology as expressed in the training materials suggests that:

- Limited attempts will be made to quantify or characterise waste, only to analyse it chemically;
- There will be a strong focus on domestic waste streams;
- The focus of sampling will be at the dumpsite, although some sampling at sources is said to be included
- There is an assumption that if there will be source separation, it will only distinguish wet and dry streams, with the wet one potentially going to composting or biogas and the dry one for post-collection sorting and incineration
- The framework for aggregation and analysis will be the individual sample, rather than type or identification of source, vehicle, season, or other parameters

These characteristics suggest that the results of the data analysis may be of limited use in identifying potentials for diversion of specific waste streams.

The UNEP/CCN initiative is reported to have been requested by the City Council of Nairobi (CCN), which last had a solid waste master planning process in 1995-97 published in 1998, financed by Japan International Cooperation Agency (JICA). The JICA consultants used data from 1995 and before, meaning that the quantitative information based on that report is almost 15 years old. At that time, the CCN was a rather marginal participant in the study, and there was little buy-in or commitment to implementing the results. As a result the CCN did not implement most of the recommendations, so that today the situation with disposal of solid waste in Nairobi is, generally speaking, the same as it was in the 1990s. There is an overfull dumpsite, Dandora, in the Eastern part of the city, and the newly proposed site in the South East, Ruai, which could be used but which is not yet built. Because of its distance from the centre, there are questions about its ability to attract waste and receive tipping fees, certainly as long as there are low-cost alternatives like Dandora or various gullies and many unofficial dumping sites.

The involvement of the National Environmental Management Agency (NEMA) is represented by the National Technical Team (NTT) a large highly capable resource stakeholder group in which many Nairobi and Kenya solid waste experts have been invited to participate.

In discussions with the team, the support that the LEI Nairobi City Compost project will offer the UNEP/CCN has been formulated as follows:

- The project aims to connect sources and users of organic waste streams and focus on large generators of relatively clean materials, that can either be used for animal feed, or processed into compost via composting, or into energy and compost via biogas, or potentially used for other energy processes like stove pellets.
- The project makes an inventory of potential industrial, commercial, institutional and agricultural sources, and audits the ones with a high potential, in order to identify substantial quantities of waste that can be relatively easily diverted, and for which markets or users are identified. The project will provide this information to the UNEP/CCN project team, together with a general sourcing and separation strategy for how to go about diverting these tons in a sustainable way.
- The project will select two to three business cases for connecting users and generators of organic wastes or their products, facilitate implementation on a pilot basis, and provide the UNEP/CCN project team with the results of these pilot projects.

In addition it was agreed that:

- André de Jager will be a member of the NTT to optimize exchange of information between two projects;
- Options will be explored of joint data collection in area of organic waste using a selection of the trained enumerators of the UNEP/CCN project
- Our project will receive comprehensive results of the UNEP/CCN survey results
- Information sharing between the two projects will be through Jane Akumu (UNEP); Benjamin Njenga (CCN); and Samuel Letema, Kenyatta University (NTT).
- During a planned workshop of the UNEP/CCN project, tentatively scheduled for August 2009, our project will present preliminary results of the survey and the implementation plan for pilot projects.

Cooperation with the UNEP/CCN project has the following potential implications:

- The UNEP/CCN process creates a critical mass of interest and legitimacy for related and similar investigations facilitating our project activities. This has already helped us visit some markets, and will be especially useful for waste audits at public institutions like universities and markets.
- The UNEP/CCN initiative means that the general level of interest in waste will be high in the coming years, creating new opportunities for networking and connecting to other initiatives.
- IETC and UCT are very interested in our results, which they see as complementing their own quite differently focused data collection. They have indicated a willingness to share their results and modify to some extend their approach and methodology to better complement our process. However, it is obvious we need to develop and organise our own data collection process in line with our requirements.

4 Main observations and conclusions

The inception mission arrived at the following observations and conclusions:

- The identified Kenyan-Dutch project team has the relevant expertise, experiences and network to be able to implement the project successfully.
- Stakeholder participation and appropriate institutional setting are essential for a successful development and implementation of the plan. This is essential since it appears limited learning and evaluation has been undertaken from a previous waste management planning process in 1995-1997 which resulted in hardly any implementation by City Council of Nairobi of the proposed actions.
- During the inception mission, it was only possible to arrive at a global overview of the waste management situation in Nairobi, and its major players. Relatively limited information could be collected on existing operators and stakeholders currently processing organic waste into compost and bio-energy, or the potential users of (and markets for) these materials and resulting end-products.
- Linkages were established with the team of the UNEP/CCN project and more detailed knowledge obtained about the planned methodology and activities of the project. It is concluded the city waste project can play a useful and essential complementary role in the UNEP/CCN project.
- During the inception mission a detailed work plan was formulated for phase 1 of the project activities to be implemented in 2009. A work plan for phase 2 will be formulated in September 2009 upon completion of phase 1.
- A comprehensive implementation of the identified activities needed to attain the project objectives is constraint by the available project budget.
- The project team has made agreements with the UNEP/CCN team on sharing of information.
- A project website will be established for external communication of project results and facilitating internal project communication (restricted access).

Appendix 1 UNEP/CCN Project Summary

United Nations Environment Programme

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PROGRAMME DES NATIONS UNIES POUR L'ENVIRONNEMENT • PROGRAMA DE LAS NACIONES UNIDAS PARA EL MEDIO AMBIENTE

ПРОГРАММА ОРГАНИЗАЦИИ ОБЪЕДИНЕННЫХ НАЦИЙ ПО ОКРУЖАЮЩЕЙ СРЕДЕ

UNITED NATIONS ENVIRONMENT PROGRAMME
PROJECT DOCUMENT

Project summary

The city of Nairobi, the capital of Kenya, with a population of more than 3 million is a centre of industry, education and culture occupying an area of 696.1 km^2 (0.1 per cent of Kenya's total surface area) and hosting about 25 per cent of Kenya's urban population (UNCHS 2001). The average density of population for Nairobi is 3079 people/km^2 (CBS 2001) but this varies significantly across the different divisions. This has impacts on the effectiveness and ability of the City Council of Nairobi (CCN) to deliver services such as waste management, health, education, transport, and so on. It is estimated that urban population will be about 3.8 million by the year 2015, requiring an immediate and comprehensive urban environmental management system, including integrated solid waste management (ISWM). There are various local, national and international initiatives aimed at improving solid waste management practices in the City of Nairobi. These initiatives range from clean-up activities under Keep Kenya Clean (3K) to UNEP assisted Sustainable Plastic Waste Management Project. These initiatives could be more effective, if they are part of a comprehensive integrated solid waste management (ISWM) system. The City recently published the 'City of Nairobi Environment Outlook' with assistance from UNEP. The document covers all the major environmental areas, including waste, to be addressed by the City Council of Nairobi with the help of local, national and international partners.

The proposed ISWM Plan will build on the existing practices and will try to strengthen waste management through scientific assessment of waste characterization and quantification with future projections, assessment of current waste management systems and gaps therein, targets and stakeholders' issues of concern for ISWM. Appropriate environmentally sound technologies and policy framework (regulatory and financing) for each component of ISWM namely: - source segregation, collection and transportation, transfer stations with material recovery for recycling, treatment and resource recovery (e.g. composting/biogas and waste to energy) and final disposal - will be identified. Detailed actions and specific schemes would be designed based on environmentally sound technologies, appropriate policy framework and implementation strategy including various types of public-private partnerships. The outcomes of the project will be disseminated at national and regional level to support its replication.

Logical framework matrix

Intervention Logic	Objectively Verifiable Indicators (OVI)	Means of Verification	Assumptions
Results: 1. Integrated Solid Waste Management (ISWM) Plan for Nairobi. 2. Increased capacity of national/local governments and professional institutions for developing and implementing Integrated Solid	1. Development of an ISWM Plan for the city of Nairobi. 2. Number of professional institutions, government departments and civil society organizations involved in preparation of	1. Document – ISWM Plan for Nairobi City and baseline reports 2. Documents – ISWM Plan for Nairobi, baseline studies and other information prepared in cooperation with professional	- Existing political will to address the solid waste management issue in Nairobi; - Availability of UNEP, Kenya Government and partner resources for the project; - Implementation of the ISWM Plan; - Cooperation of government ministries,

Waste Management Plans to replicate ISWM Plans in other cities 3. Development of relevant policies (regulatory and financial) and an implementation strategy for sustainable waste management in Kenya based on the 3R principle.	ISWM Plan 3. Number of policies and strategies for sustainable waste management in Kenya.	institutions, government departments and civil society organizations 3. Document on policy framework and strategies for ISWM.	civil society, industry, non-governmental organizations and the local community in implementation of the ISWM Plan; - Sufficient awareness and knowledge of the benefits an ISWM system; - Adequate resources and training for the various stages of developing an ISWM Plan.
Outputs: 1. Complete baseline data on solid wastes in Nairobi covering all waste types with quantities and characteristics, with future projections. 2. Assessment of present waste management system with constraints and areas for improvement. 3. Targets for ISWM Plan and stakeholder issues which need to be addressed by the ISWM Plan. 4. Integrated Waste Management Plan for implementation by CCN with basic technology specifications for different aspects of waste management responsibilities, monitoring and review processes together with a preliminary budget proposal for the implementation of the ISWM Plan. 5. Plan for each action/scheme containing the background, options for EST, relevant policies (regulatory and financing), implementation strategy including public-private partnerships if relevant, timelines, and their relevance/integration within ISWM Plan. 6. Dissemination package containing documents on lessons learnt and concise project documents including guidelines for data collection, analysis, ISWM Plan and the plan and design of a treatment and disposal facility with its implementation strategy.			
Activities: UNEP in collaboration with City Council of Nairobi, Ministry of Environment and Mineral Resources and the University of Cape Town will: 1. Assess the waste streams in the municipal area to develop a complete waste inventory through source identification, quantification and characterization, with future projections. 2. Conduct a situation analysis of the present waste management system to assess the extent and effectiveness of existing waste management practices from collection to final disposal. 3. Set targets that will be achieved through the proposed ISWM Plan while identifying stakeholder issues of concern. 4. Develop an ISWM Plan for Nairobi that will address the waste issues of the city in a wholistic and integrated manner. 5. Plan for specific actions and schemes parallel to the development of the ISWM Plan. 6. Disseminate project experiences, guidelines and the ISWM Plan for Nairobi at the national and regional level.			

Appendix 2 Project Proposal Converting City Waste into Compost

Information on the target groups of the project

Problem owner

Waste management is a growing problem in the Great lakes region. The increase in solid waste generation has not been accompanied by an equivalent increase in the capacity of relevant urban authorities to deal with it. As an example the current generation rate of garbage in the city of Nairobi alone is estimated over 2,000 tons per day and consists mostly of wet, partly decomposed biomass with smaller quantities of textile, plastic, paper, glass and metal. These cities face a major challenge in establishing an effective and efficient waste collection system. To date most of the waste is not even collected, and the waste that is collected ends up on very problematic dumpsites such as Dandora in Nairobi. Most of the material recovery for recycling is carried out by scavengers on the waste dump or even before and there is no comprehensive system for segregation at source nor any proper transfer stations to increase material recovery for recycling purposes.

There is general practice of open burning and unhealthy material recovery practices resulting to hazardous emissions that include dioxins/furans resulting in serious health problems. Hazardous medical and industrial waste is likewise dumped at such uncontrolled sites. For Nairobi the UNEP commissioned a study of the Dandora dumpsite and the initial findings suggest that there are severe public health and environmental consequences. The study shows that this dumpsite is indeed a serious threat to residents, especially children living nearby as well as city's environment in general. For example, the study found that half of the children tested had concentrations of lead in their blood that exceed internationally accepted levels. As a result of the said study the Nairobi City Council and Kenyas Ministry of Environment decided to ask UNEP to help develop a new comprehensive waste management system for Nairobi. UNEP is now assisting in the development of an Integrated Solid Waste Management (ISWM) Plan. The ISWM plan for Nairobi will look into the development of proper waste collection and disposal. The ISWM aims to reduce waste streams by at least 50% through recycling. The ISWM would consider establishing waste transfer stations where waste will be separated and recycled. The unusable waste left over will than be dumped in a new sanitary landfill that will be managed properly (the Government has announced that it will close the Dandora waste dump). The ISWM strategy foresees in the development of public private partnerships for all elements (collection, separation, recycling and disposal) of the waste. At the same time, Kenya is facing serious shortages in fertilizers and this has been compounded by the rise in oil and raw material prices which ultimately will result in higher fertilizer prices. There is a real danger of eutrophication of all open water in the Great Lakes region if artificial fertilizers are to be applied on a large scale in order uplift the agricultural sector from marginal farming to more productive levels. Meanwhile food production has been reduced with most farmers unable to meet growing demand hence resulting to food insecurity and malnourishment. Although more than 50% of the waste is organic in nature, and compost would and could improve the poor African soil structures in a very sustainable manner, only very few local composting initiatives exist to date.

UNEP and the Kenya Government are therefore interested to identify the possibilities the set up a facility that will use organic city waste to produce natural compost.

Target group

The problem owners are looking for expertise in the (economically, environmentally and institutionally) feasible management of waste streams. We are already working with other partners that are providing advice on the separation and recycling of other waste components, such as plastics. Resource recovery through decentralised, small and medium-scale composting, together with large-scale composting facilities would:

- produce a useful product with monetary value that would at least partially meet the cost of proper waste management;

- provide natural, affordable, compost to the agricultural sector rather than the massive introduction of artificial fertilizer that would be associated with a number of environmental concerns (in terms of energy and run-off plus deposits in open water);
- substantially reduce the waste to be dumped at the landfill site;
- and provide additional employment for the poor (in waste segregation, handling and storage of matters to be recycled or used as fuel, composting, etc.

The plan will consider howcompost can be diverted from disposal. This will probably be a combination of community-based source separation initiatives, formal separation systems at the transfer stations, and a pre-tipping separation area at the landfill itself. These various forms of separation are necessary in order to have some chance that the compost could meet European compost maximum standards of contamination (heavy metals, persistent organic pollutants, etc) or Kenyan fertiliser standards pro-rated based on the delivered N-P-K application rates for compost. This would help increase food production in the country. Compost, and specific blends of compost and fertilizer, can be made more affordable and accessible to both large and small scale farmers, in part through on-farm composting initiatives co-ordinated with separation activities in the city.

Support is requested for the execution of a participatory stakeholder planning process, a full-blown feasibility study, and a compost market development study and analysis, that would focus on diverting the organic fraction of the municipal waste of Nairobi via a range of locally appropriate, sustainable, micro, small, and medium-scale activities. This will examine the potential of waste separation and use of waste for recycling purposes (with a focus on job creation rather than mechanical/technical solutions); the technical, economic and region-wide environmental prospects of compost preparation with quality standards acceptable to the agricultural sector of East Africa and preferably competitive to the aforementioned chemical fertilizer.

A second phase of the project is to validate the methodology for major cities in the Great Lakes region in terms of volumes of recyclable material, volumes of compost (vis–vis the realization of a regional chemical fertilizer plant).

Project goal
Objectives of the project:

- Explore options for the development of a viable system of collecting, processing, distribution and marketing of organic city wast material for application in (perii-urban) agriculture for major cities in East Africa in general and for Nairobi in particular;
- Formulate development sceanrio's and policy recommendations for implementation.

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Starting date period of involvement	1-1-2009		
End date period of involvement	31-12-2010		

Work plan (provisional)

Proposed approach and time frame
The activities focus on economical, environmental and institutional issues related to waste management

The project will implement conduct the following activities:

- Analysis existing urban waste management system in Nairobi;
    - Survey of existing municipal waste management systems and stakeholders analysis:
    - Inventory and analysis of relevant policies affecting waste management and use of organic material in (peri-urban) agriculture;
    - Analysis of quality of different types of city waste;
    - Identify constraints and potentials for use of urban waste for composting.
- Exploring technical, environmental and economical options for compost production;
    - Stakeholders meeting discussing options for compost production from city waste;
    - Discuss and formulate a design of viable system of collecting, processing, distribution and marketing of organic city wast material for application in (peri-urban) agriculture with a focus on organisational, technical, environmental and economical feasibility;
    - Design a pilot activity testing a system on a limited scale.
- Pilot implementation of sustainable composting making unit (in public-private partnership setting);
    - Identification of partners (public and private) willing to participate in pilot activity;
    - Implementation of pilot project;
    - Monitoring and evaluation of pilot project.
- Formulation of implementation scenario's
    - Based upon feasibility study and results of pilot project, formulation of wide-scale implementation scenario's for public-private city waste processing into compost for Nairobi and other major cities in East Africa;
    - Stakeholders meeting discussing various implementation scenario's;
    - Contribution to the establishment of national public-private partnerships for implementation of city waste processing into compost.

Proposed timeframe:

Activities	**Who**	**2009**				**2010**			
		Q1	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
Analysis existing waste management systems Nairobi	LEI, Alterra, Waste	X	X						
Exploring options compost production	Alterra		X	X					
Pilot implementation	Alterra, LEI				X	X	X	X	
Formulation implementation scenario's	LEI, Waste							X	X

Proposed results and products
The project activities will lead to the following outputs:
- Report on current waste management system and relevant policies in Nairobi;
- Report on technical, environmental and economical options and challenges in composting for (peri-urban) agriculture use;
- Implementation and results of pilot implementation project;
- Feasibility report presenting implementation scenario's for Nairobi and other East Africa cities;
- Two symposia organised jointly with UNEP.

End date
31-12-2010

Monitoring and evaluation method

- Determination of critical success factors of the project and methods of measurement at the start of the project;
- Regular monitoring by project partners on critical success factors;
- Regular project meetings and feedback to problem owners;
- Participatory evaluation during stakeholder meetings.

Proposed communication plan and knowledge transfer to the target groups
Integrated in the workplan are workshops, publication of papers and policy briefs and maintaining of a project website.

The project will be integrated in ongoing activities by UNEP and City Council of Nairobi and results will be disseminated through their communication channels.

Budget

€ 75,000 for 2009

Appendix 3 Expertise and responsibilities project partners

Organisation	Project person	Expertise/ responsibilities
LEI	Andre de Jager and Yuca Waarts	Project management and reporting Liaison to UNEP, NTT, CCN Reporting to Dutch Embassy External communication about project in Africa Inventory, analysis and mapping of dealers/end users of organic waste streams Identification of real or latent markets for compost and other products, market strategies Interactions with agricultural, horticultural, and development stakeholders and processes in Nairobi Preparing project reports and information products Design of marketing/beneficial use strategy Inputs to pilot project selection and design Economics/cost analysis of proposed pilot projects
WASTE	Anne Scheinberg (possible others, depending on content of work)	Context of solid waste in Nairobi, Kenya, E. Africa Inventory, analysis and mapping non-household organic waste streams and process flows Interactions with solid waste / recycling/composting stakeholders and processes in Nairobi Preparing inputs for UNEP/CCN process Design of sourcing strategy Inputs to implementing partner selection, and to pilot project selection and design Quality control on solid waste and recycling outputs ISWM and field assessment tools, techniques, training materials
Alterra	Kor Zwart	Technical and operational parameters Technology assessment for pilot projects Testing and analysis of compostables, compost, soils, leachate, etc Technical inputs for pilot projects Logistics, economy of scale, operational parameters
ETC East Africa	Davies Onduru	Institutional and marketing analysis of agricultural and horticultural markets and users Institutional, success, and failure of organic waste management in Nairobi and Kenya Liaison to ag stakeholders Identification and analysis of past, current, existing and planned composting, biogas, and organic waste management in the ag and horticulture sectors and rural and peri-urban areas Identification of urban implementing partners/owners Point person on data collection on markets, users, technical and other parameters Inputs to pilot project selection, design, monitoring
ECM Centre	Joyce Gachugi and Paul Kirai	Data collection and analysis of supply of organic waste and materials Point persons on quantification of supplies of organic materials Identification and analysis of past, current, existing and planned composting, biogas, and organic waste management in the urban and peri-urban areas Institutional, success, and failure of organic waste management in Nairobi and Kenya Co-production of quantification estimates and diversion strategy for UNEP-CCN process Identification of urban implementing partners/owners Inputs to pilot project selection, design, monitoring Permits, licenses, legal preparation for pilot projects CDM applications and identification of carbon partners

Appendix 4 Itinerary

Sunday March 15	Travel Dutch members project team Amsterdam – Nairobi
Monday March 16	Discussion project team on mission program at ETC office
	Arranging appointments
	Field visit to Kibichoi Farmers Field School (composting and biogas in rural setting)
Tuesday March 17	Participation official launch Integrated Solid Waste Management Plan for Nairobi at UNEP
	Discussion with project team UNEP- Nairobi; UNEP-IETC and University of Cape Town
Wednesday March 18	Attending training session for enumerators facilitated by UNEP-IETC and University of Cape Town
	Project team discussion on approach, activities and linkages with UNEP/CCN project
Thursday March 19	Field visit Southeast of Nairobi (Kayole) to plastic recycling operation and Ruai where new landfill will be located
	Project team meeting on approach and workplan at ECM office
	Discussion with representatives of CarbonAfrica on possible collaboration
	Team diner
Friday March 20	Debriefing with Agricultural Counselor at Royal Netherlands Embassy (Kor and André only)
	Rapid survey of 3 key markets in Nairobi
	Wrap-up team meeting at ETC office
Saturday/Sunday March 21/22	Report writing and informal discussions Travel Dutch team members Nairobi - Amsterdam

Appendix 5 Short notes on field visits

Biogas and Composting in Kiambu District (Monday March 16)

The team visited Kibichoi Farmer Field School in Githunguri Division of Kiambu District with the objective of (i) acquainting team members with the use of waste in generating biogas; and (ii) the use of waste in composting.

Use of waste in biogas generation
In Kibichoi, the team visited one smallholder dairy farmer with fixed dome reactor, one of the three common reactors found in Kenya; others are floating drum and tubular reactors. Fixed domes were introduced in Kenya in 1990's and are currently being promoted by Sustainable Community Development Services Programme (SCODE), PEMAGI Energy Ltd, Renewable Energy Engineering Contractors (REECON) and GTZ PSDA. This type of digester was first introduced to Kenya through Tanzania. Whereas the principles of *methanisation* remain the same, the key difference with this type of digester is that it is built on or more usually under ground level, with only the plumbing, inlet and outlets visible.
The farmer installed the fixed dome digester through the assistance of SACDEP Kenya working in collaboration with GTZ. SACDEP has trained technicians for this purpose. The unit built is 16-m^3 capacity with a gas holding chamber of 3.8 m^3. The following observations were made during the visit:

- The digester is fed using slurry (cattle manure-water mixture) and pig manure; the farmer currently has enough manure from her own cattle and pigs.
- At time of construction, the biogas unit cost was Ksh. 60 000; since then the cost has to Ksh 90 000-100 000
- The farmer produces sufficient gas for domestic use-cooking; the gas is produced in surplus.
- The dung/slurry outputs from the digester are used for growing Napier grass (fodder for cattle).
- There are locally available technicians in Githunguri, building biogas units at a cost
- According to the farmer, the pressure from the fixed dome is high.
- Biogas cookers are available locally, and Jua Kali artisans have been able to fabricate new ones or modify LPG stoves to use biogas which is much cheaper. However, there is little or no quality control on biogas appliances.

Challenges

- The uptake of biogas system is slow due to high initial costs; In Githungiri most farmers have dairy cattle and manure for feeding the digester.

Use of waste in composting

One farmer making compost was visited in Githunguri. Compost making is popular among group members in Kibichoi due to previous training they received during the farmer field school process. The following observations were made on the farm visited:

- Practices shallow pit composting (pit size of 4ft wide x 8ft long x 0.5-1 ft deep);
- Composting materials used include cattle manure, kitchen waste, farm waste, dry grass/twigs, ash and water;
- The composting materials are laid in sequential layers up to 4-5ft high;
- The compost is made during the dry season in readiness for planting in the rainy period;
- Compost is turned frequently (3 times) to speed up decomposition; and takes about 63 days to mature; the mature compost is covered with dry grass;
- Compost is used in planting potatoes, bananas, coffee etc; applied to coffee every season;
- It is perceived that crops grown using compost does better than those planted using inorganic fertilizers only, especially during periods of moisture stress;
- Some farmers in the neighbourhood, of late, have been buying compost from the farmer; although the uptake of compost is slow.

Launching Ceremony of Integrated Solid Waste Management Plan Nairobi; UNEP/CCN Project (Tuesday March 17)

The launch was organised at UNEP and attended by approximately 40 persons. The program consisted of the following introductions:

- Opening remarks by Peter Acquah, Deputy Director Regional UNEP Regional Office of Africa
- Environmental Challenges facing Nairobi by Phillip Abongo, Chairman Environmental Committee
- Overview of Nairobi River Basin Program by Carol Wamae, Ministry of Environmental and Mineral Resources
- Overview of ISWM by Surya Chandak, UNEP-IETC
- Learning from UNEP experiences; case study of Lesotho by Harro von Blottnits, Chemical Engeneering Department University of Cape Town
- Proposed implementation plan by Benjamin Njenga, City Council Nairobi

These introductions were followed by a plenary discussion mainly focusing on the intended approach of the ISWM for Nairobi. During the discussion our project was given the floor to briefly introduce our project activities and the intended integration of this project in the ISWM plan for Nairobi. The focus on exploring re-use of organic waste in agriculture/energy applications was well-received and considered to be a valuable complementary activity.

Observations made:

- It appears no learning and evaluation has been undertaken from a previous waste management planning process in 1995-1997 (financed by JICA) which resulted in hardly any implementation by City Council of Nairobi of the proposed actions; why developing a new plan before evaluating the failure of the previous plan?
- Achievements so far by NEMA in Nairobi, in cooperation with the CCN:

    - A demo-stretch of 2,5 km (Globe cinema to Museum Hill) on landscaping riparian zone
    - 3 quarries identified as potential interim dumping sites
    - Giving out tree seedlings
    - Stopping illegal dumping outside of designated locations and along the riverbanks
- Stakeholder participation and an appropriate institutional setting are essential for a successful development and implementation of the plan. Presented example in Lesotho also showed limited implementation yet. Questions are raised whether in the current ISWM a proper stakeholder participation process is organised.
- The National Technical Team consisting of Ministries, NEMA, Practical action, Universities, CCN, UNEP is the coordinating body of the project.

In the afternoon the project team met with the UNEP/CCN team to discuss integration of the project activities. Present during this meeting were:

- Mushtaq Ahmed Memon, IETC/UNEP
- Surya Prakash Chandak, IETC/UNDP
- Dr. Harro von Blottnitz, University of Cape Town
- Jane Akumu and Annemarie Kinyanjui, UNEP
- Kenyan-Dutch project team

During the meeting it was agreed:

- André will be a member of the NTT to optimize exchange of information between two projects;
- Options will be explored of joint data collection in area of organic waste using a selection of the trained enumerators of the UNEP/CCN project
- Our project will share information on the organic survey results with the UNEP/CCN team and our project will receive comprehensive results of the UNEP/CCN survey results
- Information sharing between the two projects will be through Jane Akumu (UNEP) and Benjamin Njenga (CCN)
- During a planned workshop of the UNEP/CCN project in August 2009, our project can present preliminary results of the survey and the implementation plan for pilot projects.

Recent changes in Nairobi Waste management system

If **disposal** in and for Nairobi has changed little in the intervening years since 1998, this is less true of **collection**. A major revamping of the solid waste collection system occurred in 2006-2007, under the joint leadership of the National Environmental Management Agency (NEMA) and the CCN. As far as can be determined without a detailed review of history and associated regulatory documents, this has the following characteristics:

- NEMA has introduced a licensing process for vehicles and enterprises that transport solid waste. Indications are that “solid waste” is defined broadly (NEMA makes clear separation between hazardous and regular waste), but does not (yet or explicitly) exclude recyclable or compostable materials, even when these have an economic value an are being transported for sale. The licensing process is reasonably easy, transparent, and affordable, but vehicles operating without are subject to steep fines.

- The CCN, even though it has only a small number of vehicles, has greatly increased the regularity and professionalism of its own collection operations, and the city is considerably cleaner. These operations cover:
    - removing waste from markets, transport terminals, public areas and institutions,
    - street sweeping, litter control (which is legislated and liable to fines), and general clean-up (generally one process in non-OECD cities)
    - removal of daily or longer-term accumulation waste from roadsides, vacant lots, and other unofficial dumping sites
    - management and cleaning of parks and open spaces, of which there are a great many in Nairobi
- The CCN has put itself in charge of a (micro-)franchising process for solid waste collection, so that Community Based Organisations (CBOs), NGOs, and Micro and Small Enterprises (MSEs) who have earned livelihoods by collecting waste in their areas can no longer do this without being assigned the right to the district by the CCN. This type of franchising was developed into the premium model for improving collection coverage in Dar es Salaam with the support of the International Labour Organisation (ILO). The essence of this model is that the franchising process looks at organisational financial capacity and the type of vehicles as the basis for assigning the franchise; the franchise is renewable yearly or at some other interval; and the franchise consists of several rights and obligations:
    - the right to collect waste, either mixed or separated into compostables and recyclables, and
    - the right to collect payments from the clients
    - the obligation to meet the demands of city or NEMA inspectors who are there to inspect on results

  In this model, widely seen as the best way for (Anglophone) African cities to achieve better access to services, the city or sub-municipal unit does not usually enforce the obligation to pay, although they do earn the fines and legal fees when payers default. There are some reports that the franchising process in Nairobi is not entirely clean.
- As a result of this process, the number of private collectors and the service options they offer has grown significantly: in 1999 the list included 10 firms, now the total is about 150. These range in size from large private companies like BINS Ltd, which still collects the CBD, to small CBOs, NGOs, and MSEs. This represents a significant increase in capacity for waste management, which could mean that our project could have both more options, and more risks, than it would have had in 1999. On the other hand, this may not be applicable for institutional waste.

Training UNEP/CCN Project team (Wednesday March 18)

The following day the project team shortly attended the training session for student enumerators facilitated by IETC and University of Cape Town. The following observations were made:

- Students do not have experience in waste management, have limited experience in implementing surveys
- It is a classroom training and lacks practical exercises;

- Appropriate and intensive guidance and supervision of the student enumerators is therefore necessary takes to be able to implement a good-quality data collection exercise and attaining reliable results.

Field visit Kayole (Thursday March 19)

A visit was made to the plastics recycling operation of Mr. S.N. Munywe who represents a private MSE called Kema Re-using LD Plastics and a CBO called Kayole Environmental. The field visit was in the Southeast of Nairobi, and included the area called Kayole and a compost site in the area of Ruai, where the new landfill will be located.

Kema Re-Using L.D. Plastics
We went first to a private house in Kayole area where there were remnants of a plastics processing operation were shown to us, including photographs and a hand press, and sample roofing tiles. The tiles were about 40 cm square, about 2 cm thick, and not completely uniform in thickness, with a mixed colour showing the original plastics used. The process used was to heat plastics, probably mostly LDPE, in a cast iron cauldron of a sort usually used for household cooking. The melted plastics were cast into a mold to make roofing tiles, apparently one at a time. According to Mr. Munywe, more than 10,000 tiles were made, and about 3,000 were sold. The price per tile was not mentioned. In answer to a question as to whether the tiles melted in use, he stated that they were not vulnerable to melting. It was not stated whether there were additives or what the recipe was, nor where the remaining 7,000 tiles are stored. However, it was clear that this operation is no longer active, and that there is a desire to start it up again on a different site, with external capital.

Kayole Environmental
Kayole environmental is portrayed as a classic E. African CBO which began in 2000 to collect waste from households in its area of Kayole. The cost for the service was Ksh 40 per household per month in 2000, and in 2008, when operations stopped, it had risen to Ksh 120. At the peak, it served 12,000 households with a system of washable waste bags. The collection was three times per week per household, and collected about 7 kg per household per week. Each hand-cart had a route of about 500 households. The hand-cart operator provided a clean, washed bag in return for a bag of waste in the reusable washable bag. According to Mr. Munywe, the group consisted of about 100 persons, of whom 80 were active in the collection, organised in cells, and the rest in the administration.

The group used an unclaimed site for transfer and composting. They separated non-organic waste and composted the organic waste, using the plant Tithonia, known for its high N and P content, as an enricher, and produced about 1.000 tons. The compost was sold for about Ksh 3 per kg, and was tested to have an NPK content of 6-4-4 (which was seriously doubted to be realistic by the experts in the team).

This operation ended in 2007 when the new rules of NEMA required CBOs to be licensed and their site was repossessed. It was unclear why Kayole did not successfully register, but Mr. Munywe implied that there was political influence to give the concession

to a private company. It was reported that they had sold some compost, but that they lost about 200 tons of finished compost when the site was repossessed.

The CBO would like to resume operations but have not attempted to re-register themselves. Mr. Munywe reported plans for recovery of compost from markets, on the model of the women's group at the City Park Market opposite the Aga Khan market. He showed us a plot of ¾ acre in a new area where some women were waiting for us in a shed, and asked for €14,000 investment funds to start composting at that site. He provided a pro-forma budget for composting.

Field visit of key markets (Friday 20th march 2009)

The Dutch team was accompanied by:

- Samuel Latema – UNEP/IETC/CCN team member
- Marrian Mutete Kioko – City Council of Nairobi
- Mr. Ng'anga – City Council of Nairobi

The following markets were visited:

- Kangemi-Kinare Market
- City Park Market
- City Market

The objectives of the preliminary field study were to:

- Practice looking at waste and analyze the quantities of observed materials;
- Understand the structure of organic waste management in the markets;
- Use the snowball technique to establish the current use of organic waste, destinations of waste, players involved, and claims on the waste itself.

Summary of the field visits

The City Council of Nairobi's representatives facilitated the team's access to the markets, through the coordination of access protocol procedures into the market with the relevant market authorities. The markets that the team visited are all public markets, under the jurisdiction of the City Council of Nairobi's planning department. However, the Kinare market, adjacent to the Kangemi market is privately owned.

Kangemi-kinare Market

Kangemi and Kinare markets are situated along the Nairobi-Naivasha highway, in the Westlands zone of the City Council of Nairobi. The Kangemi Market is run by the department of planning within the council. The market is therefore managed by a representative of the City Council, alongside a team of other officials.

The Kinare market, which is situated right next to the Kangemi market, is privately owned by individuals, who have selected a committee to oversee the day-to-day management operations of market. Both the chairman of the Kinare market and the Zonal officer from the Kangemi market took the team through both markets.

Team Observations and Findings

Both markets are well organized. The Kinare market has about 700 stalls while the Kangemi market has 100 stalls for the traders.

In the Kinare market, the waste management system is such that, each stall owner dumps his/her waste, at a common collection site within the market. After this, the market's management pays some loaders to carry the waste into trucks/ pick-ups, owned by farmers who take the waste, for free, for use on their farms as manure.

From our observations, most of the waste at this collection site was organic waste, contaminated with plastics. This is probably because 300-400 of the stalls within this market are fruit and/or vegetable stalls. It was also observed that the waste was not a lot; the chairman at the market informed the team, that amount of waste was not much due to the dry season being experienced in the country at present. However, during the cold and wet season the amount of waste increased exponentially.

The waste we observed was already in the composting/rotting process, with a strong smell of organic acids emanating from the waste heap being noted by the team. The team was informed that most of the waste at the collection site is carried away every month during the dry season and weekly during the rainy season. However the waste from bananas, cabbages and maize is carried away more regularly, by farmers, who deem it as more valuable waste from the market.

Currently, no waste is being ferried out of this private market, hence; it is assumed that the waste generated in this market does not end up at the main Dandora dumpsite.

The Kangemi market is much smaller than the Kinare market. This market, which is ran by the City Council of Nairobi, has more than 50% of its stalls occupied by cloth traders. The team therefore observed that the market does not generate a lot of organic waste. However, the waste management system at this market is such that, there are sweepers, paid by the council, to sweep the market, they then collect this waste and dump it on the side of the main highway. The waste is then collected by either of the two contractors hired by the council to collect waste at the market.

The team noted that the waste from this market would have contaminated organic waste, as the mode of waste collected is through sweeping. Moreover, the team observed, that in order to adequately monitor the waste collection from this market, a study would need to be undertaken at 8.00am in the morning.

City Park Market

This market is situated along Limuru Road, opposite the Aga Khan Hospital. The market is a public market, which was constructed by the Asian foundation in Kenya, but is managed solely by the City Council of Nairobi. The market has a capacity of 1820 stalls; however, only 600 stalls are actively operating. Out the actively operating stalls, 300 stalls are for fruits and/or vegetables.

Team Observations and Findings

It was observed that this market generated a lot of organic waste, in comparison to the first two markets visited. The team also noted that this market was very clean, and well organized.

The waste management system at the market is mainly by dumping of waste at the common collection site at the periphery of the market. The dumped waste is then

collected by the City Council of Nairobi's trucks every month. There are also, a few farmers, as well as private collectors, who collect some of the organic waste from the dump site, for use on their farmers or to sell to farmers.

This market has an ongoing in-market compositing system, which is run by a local women's group. The group has been compositing since 1991, when the market opened, in an area next to the markets dumpsite.

It was also observed that there were heaps that were currently composting. The team was able to speak to the boys who assist the women in the composting, in one way or another. From these talks, it was noted that the women generated about 30 bags of compost manure every month. Each bag weighed 20 kg. These bags, are then sold to farmers at a price of Ksh.20 per kg. The team was informed that the compost heaps were turned every Monday and Thursday of every week. The market's management does not charge the women's group for any of the compost generated from the market waste.
The present composting capacity is far too little to convert all the organic waste from the market into compost, resulting in a relatively large waste dump.

City Market
This market is located in the Central Business District of Nairobi. It is a 24 hour market, managed by the City Council of Nairobi. This market has 120 stalls in operation; out of these 26 are fruit and vegetable traders, while 56 are flower traders, the 38 remaining stalls are occupied by craft, curio and meat traders.

Team Observations and Findings
It was observed that the market was well organized, and generally clean in most sections. The traders had also been clustered according to the products that they sell, such that the meat, fruit-vegetable and flower trader were in a more open area, while the craft traders were in an enclosed area.

The team arrived at the market at 2.00 pm, thus we found that the waste had already been collected. The market manager informed us, that the waste management system at the market had changed, such that, now, each trader collects his own waste, and disposes it off into the collection truck at 10.00am each morning. In the past, the traders would dump their waste, at the back entrance/exit of the market and then city council's trucks would collect the waste daily, from there. The reason for the change in waste management system was due to regulatory issues with the National Environmental Management Authority, whose regulatory framework does not allow for open dumping of waste that poses a public health issue.

Generally the team was unable to analyze and observe any waste at this market due it already having been collected. However, the team's members felt that this market would be a good source of a more pure form of organic waste as compared to the other markets, due to its waste collection system.

Conclusions
- The team concluded that, as part of its project, it may be beneficial to consider the setting up of in-market compositing units.
- Separation of wastes on site, during waste collection could be fronted to the markets, during the project study, as part of a linkage between improving

relations between our project and the markets as well as improving the waste collection methodologies currently in place.

- Generally, the team felt that, the markets visited in this study were only mid-level producers of organic wastes, and as such during the actual project study, the high-level producers of organic wastes should be targeted.
- In contrast to the ideas going into the mission, the visits to markets gave the team members the idea that on-site pre-treatment and treatment of organic materials deserves serious consideration. On-site management should be considered as the model for at least one of the pilot projects.

Meeting Carbon Africa (Saturday March 21)

In a meeting on 19 March between Anne Scheinberg and Matthew Woods, the parties agreed that it would be highly advantageous to combine the organic waste sources inventory process in the period April-May-June 2009. The basic points agreed upon, which can also serve as the basis for an MoU between ECMC, Carbon Africa (CA) and the project are the following:

1. There will be sharing and co-ordination of the overall methodology for the organic waste sourcing analysis
2. There will be concrete agreement on the data base and spreadsheets for quantitative data, and all quantitative data will be shared and aggregated together
3. If possible, ECMC and CA data collectors will go together to the field for at least some of the audits
4. Each organisation will do their own write-ups and data entry, unless otherwise agreed
5. Neither organisation will pay the staff of the other, however
6. The payment of modest stipends to third-party data collectors, such as students, will in principle be shared
7. All information and data will be jointly owned by CA, ECMC and the rest of the project team
8. All parties agree to sharing of aggregate and general information with the NTT. Some specific information which CA may want to use for its investors may be held back from the NTT until the end of 2010.
9. Both groups will look at further synergies, including making bankable business plans for the “pilot” projects which can be used to attract CA investors to finance or become equity investors.
10. Other synergies will be discussed as they arise.

This type of an MoU appears to be win-win, but it requires some co-ordination in the beginning to get the methodologies synchronised, and to jointly develop data and aggregation formats. The fact that ECMC partner Tom Owino is working closely with CA should facilitate the organisational relationship.

Appendix 6 Work plan

6.1 Introduction

The workplan describes the overall approach envisaged in the 2-year project period. Within the project three phases are distinguished:

- Inventory and Assessment (Phase 1);
- Preparation and implementation of pilot projects (Phase 2);
- Analysis and information sharing (Phase 3).

A detailed workplan and budget breakdown will be presented for phase 1, for phase 2 this will be done in the second half of 2009 upon completion of most of the activities in phase 1.

6.2 Project phases and activities

In the following table a global overview of the activities in the three distinguished project phases are presented:

Phase 1: Inventory and Assessment
Period: April 2009 – June 2009
Activities: 1. Inventory and analysis of organic waste sources 2. Inventory and analysis of users, producers and markets for compost and bio-energy 3. Inventory and analysis of solid waste- and agriculture-based composting, biogas, and treatment projects in Africa 4. Analysis of institutional environment of waste management and (peri-) urban agricultural domain 5. Quantification and characterisation non-domestic organic waste streams (sources, quantified flows and destinations, including mapping) as input to UNEP/CCN project 6. Formulation of concept sourcing strategies for UNEP/CCN project
Expected outputs: 1. 6 project reports
Phase 2: Preparation and implementation of pilot projects
Period: July 2009 – December 2010
Activities: 1. Formulation of criteria, priorities and objectives for pilot projects 2. Inventory of relevant existing (commercial) compost or bio-waste businesses and operators with interest and commitment to participate in pilot projects 3. Shortlist of potential pilot projects and describe potential contributions to project objectives 4. Selection of 2-3 pilot projects 5. Jointly with pilot partners formulation of detail pilot project work plan 6. Implementation, monitoring and regular evaluation of pilot projects
Expected outputs: 1. 2-3 pilot projects implemented 2. Monitoring and evaluation reports on pilot projects

Phase 3: Analysis and information sharing
Period: April 2009 – December 2010
Activities: 1. Analysis of pilot projects according to described objectives of the pilot and the contribution to the overall project objectives 2. Participatory formulation of action plan for various stakeholders 3. Formulation of policy briefs and news items on project website 4. Stakeholders workshop in collaboration with UNEP/CCN
Expected outputs: 1. Final project report 2. At least two policy briefs 3. Stakeholders workshop organised 4. Regular news items published on project website

6.3 Description of activities Phase 1

6.3.1 Inventory Organic Waste Sources

There are three main goals to this part of the workplan:

- Understanding and mapping flows and sources of organic waste generated, processed, used, trade;
- For each source, estimating quantity, composition, and seasonal variation of organic waste streams generated, in a way that allows production of daily and yearly quantities and materials to be diverted from the non-domestic waste stream;
- Sketching the context for each particular stream generated, so as to be able to locate it as part of an existing industrial or agricultural value chain. This means understanding destinations of waste, actors involved, claims on the waste itself, and established value for the waste or intermediate products.

The following actions will be implemented:

Establishing a list of likely sources

- Making a list. We have already established a preliminary list and classification of types of sources:

Public or para-statal sources	Public or private combined sources and users	Private or NGO sources
Markets, fish markets	Roadside nurseries	Markets
Slaughterhouses	Dairy businesses	Halal slaughterhouses
Army bases	Mushroom producers	Fruit processors, Pick n Peel
Universities	Hotels, country clubs, golf courses	Pickle/jam producers, canneries, etc
Boarding schools	Sport facilities, stadium, parks	Posho and grain mills
Police stables		Jockey club, private stables
Prisons		Supermarket or greengrocer chains
Hospitals, clinics		Hospitals, clinics
Private homes on large plots		Breweries
Urine from ecosan public toilets		Urine from ecosan private toilets

- This list needs to be translated to actual business addresses, with contact information, as well as mapped.

Preparing site visits

- Making a project summary
  The preparation for site visits is different for public and private sites, but there is a common first step, which is preparing a one-page description of the project and its goals, with English on one side and Swahili on the other side, and the address and contact info of ECMC.
- Letter for public sources
  For public sources, a letter is needed from the City Council of Nairobi (CCN) to each of the sources. This has already been agreed to by Mr. Njenga, but first the sources to be visited have to be identified so that the letters can be specific.
- Letter/Fax for private sources
  For the private sources, the initial contact may be by letter or email or fax, depending on whether they are known to ECMC or other members of the project team. For these contacts, a general letter of endorsement of our project from the CCN would be extremely useful
- Scheduling the field visits
  The field visits should be scheduled in such a way as to be able to cluster visits within walking or short transportation distances. Where the visits will be made together with students or Carbon Africa, there will need to be co-ordination of joint availability.

Auditing the sources

In general, it is recommended to have an auditing team of 2 persons, where one does most of the talking and the other one takes notes, and writes these up afterwards. The note-taker will generally also do the data entry.
The different kinds of basic information include:

- name of market, address, phone number of the manager, location of manager's office
- size in turnover or number of marketeers (or other parameter),
- name and co-ordinates of market manager; contact persons for the market; and/or associations of vendors,
- names and contact info of waste companies, NCC contractors, CBOs or MSEs collecting waste
- systems (or lack of them) for waste removal, including informal and formal collectors, logistics, and destination of waste
- information, including quantity and types, of any wastes that are removed for recycling, composting, swine or cattle feeding, or for processing into human or animal food or use as soil conditioners
- contact information for the permitting installation at the NCC
- Photo-documentation of waste behind or near the stalls, on the ground, in containers, and however it is discharged.
- Quantity and composition of the waste generated, and, separately, of the waste from the market that actually reaches formal disposal.
- Sketch map of the inside and perimeter of the market with location of skips, heaps, and other kinds of waste accumulations
- systems (or lack of them) for waste removal, including skip volume and

contractor, other informal and formal collectors, logistics, and destination of waste
- information, including quantity and types, of any wastes that are removed for recycling, composting, swine or cattle feeding, or for processing into human or animal food or use as soil conditioners
- contact information for the permitting installation at the NCC
- Photo-documentation of waste inside, in containers, and however it is discharged.
- Mapping and information on specific organic waste destinations, including:
    - swine or cattle feeding operations
    - informal recovery for other purposes
    - herders of swine, goats, or cattle who depend on dumpsites or transfer stations for their herds to graze
    - composting or biogas projects or installations (or plans or failed projects)
    - chipping of woody wastes for use as mulch or top-dressing, or as a fuel
    - organised biomass-to-fuel operations, such as pelletising of coconut fibres or sawdust, making of fuel pellets or charcoal, etc.
    - other organised informal or formal initiatives to valorise (use with economic benefit) putrescible materials from the commercial, industrial, or household waste streams
    - fertiliser producers, blenders, importers, or dealers
    - nurseries within the urban and peri-urban area
    - promoters of composting or biogas, including equipment dealers
    - Other relevant information

Documentation, entering and aggregating the data
Post-audit there are three processes which are quite essential. The first is to make a narrative record of the site visit, which contextualises the numerical data and gives the opportunity for observations and insights that will be useful later. This should also include names and contact information, both of persons interviewed, *and of other persons mentioned who might have additional information or more influence over decision-making*

The second process is to enter the data in the agreed-upon format, that will permit aggregation by type of source, location, or size of source. For this a simple data base that can report and sum on different parameters would be useful.

The third process is to map the source and the current handling and destinations of waste materials into the global process flow and materials balance for non-domestic organic waste in Nairobi.

6.3.2 Inventory of users, producers and markets for compost and bio-energy

To minimize duplication of efforts among partners in terms of actual field activities and to avoid interviewing one respond by different partner agencies on one topical issue, it is suggested that a value chain approach to analysis of current situation be adopted with regards to:
- Compost for agricultural and horticultural uses;
- animal feeds (production to end use);

- Biogas plants (production to end use).

This implies one partner can undertake activities in compost and animal feeds (whole value chain from production/entrepreneurship to end use) in phase I separate from a partner carrying out biogas (entrepreneurship to end use).

Identify and map compost and enhanced animal feed users in Nairobi and peri-urban areas.

- Existing compost users in Nairobi and in the peri-urban areas of Nairobi will be inventoried and mapped through the following sub-activities:
- Desk reviews, making contacts and up-dating current information available on compost and animal feed users. In Kenya, there is a close linkage between the producers and users of compost and either of these chain actors can provide information on compost use or composting activities. The same also holds true for animal feed users. These reviews and contacts will help refine study design.
- Formulation of study instrument (checklist; semi-structured discussion guide/questionnaire). The study instrument will be used in data capture/making inventory.
- Data collection and reporting. Data collection and reporting. Data capture will be on the following among others, compost operations/entrepreneurs, compost inflows/value addition, equipment input suppliers, potential implementation partners (innovators/technical partners) and users/willingness to pay. Data collection and reporting will be done through field visits to the following chain actors:
- Producers of compost and animal feed. Since in Kenya, there is a linkage between those who produce compost and animal feed, and how they use the same (own use or sell), these category of chain actors will be visited to identify who purchases compost or animal feed from them and how the chain relationship is like (perceptions of buyers on quality prices, availability, exact use etc).
- Formal business entities: Some business entities, defined in a general sense, are hypothesized to be compost users and or animal feed users; for example those dealing in landscaping; interior decoration, agro-vets and animal feeds etc. Inventory of these business entities will be made and selected entities visited to inventories on compost use and willingness to pay factors.
- Urban and peri-urban gardening sites: A visit will be made to nursery operators, urban and peri-urban gardening sites etc to collect data on compost and animal feed users and “willingness to buy” factors.

Identify and map biogas users in Nairobi and peri-urban areas

- Desk reviews, making contacts and up-dating current information available on biogas entrepreneurs and users. The premise is that biogas entrepreneurs fabricate biogas plants for sell and therefore have some knowledge on who the buyers are. These reviews and contacts will help refine study design.
- *Formulation of study instrument* (checklist; semi-structured discussion guide/questionnaire). The study instrument will be used in data capture/making inventory.
- Data collection and reporting. Data capture will be on the following among others, biogas operations/entrepreneurs, equipment input suppliers, equipment output (digestate) users, potential implementation partners (innovators/technical partners) and users/willingness to pay. Data collection and reporting will be done through field visits to the following chain actors:

- *Entrepreneurs of biogas reactors and associated.* There is a close linkage between those who produce biogas and how they use the digestate (own use or sell), these category of chain actors will be visited to identify who purchases digestate from them and how the chain relationship is like (perceptions of buyers on quality prices, availability, exact use etc).
- *Formal business entities:* Some business entities, defined in a general sense, are hypothesized to be digestate users; for example those dealing in landscaping; interior decoration, agro-vets and animal feeds etc. Inventory of these business entities will be made and selected entities visited to inventories on compost use and willingness to pay factors.
- *Urban and peri-urban gardening sites*: A visit will be made to nursery operators, urban and peri-urban gardening sites to collect data on digestate users and "willingness to buy" factors.

6.3.3 Inventory of solid waste composting, biogas and treatment projects

A short review will be conducted on documented experiences with existing solid waste composting, biogas or other treatment procedures. Focus will be on an inventory and analysis of failed and successful projects or commercial enterprises preferably in Africa.

6.3.4 Analysis of institutional environment

Although the UNEP/CCN project will be doing an institutional and policy analysis which our project can use, it will (a) come later, and (b) have a principally different focus than ours. So this part of the workplan is focused on specific information which is needed to move from the assessment to operational pilot initiatives.

Goals and Boundaries

The goals of the scan are: to characterise the policy and enabling environment in the two major policy domains that affect the project, specifically:

- The environmental and solid waste policy domain, and
- The peri-urban and urban agricultural and horticultural domain

In addition, two flanking areas of policy and institutional context are potentially relevant, specifically:

- The industrial facility domain
- Carbon financing and other investment sources for the pilot projects

The scan will avoid duplicating the institutional research of the UNEP/CCN team wherever possible. The focus of the activity will be on identifying constraints and opportunities that will affect the team's ability to facilitate sustainable relations between users of organic materials and sources of materials in the pilot projects.

Preparation and Research

A rather incomplete list of areas to be researched follows, and should be added to by other project partners.

- The current state of non-domestic solid waste management policy, since the round of changes at NEMA and the CCN two years ago
- Clarification of laws, regulations, policies about rights and obligations for waste

generators, transporters, and users, including the legal points at which ownership of waste materials changes
- Regulations, licenses, permits needed for transporting or processing waste streams, including fees, taxes, fines, etc., as well as the administrative process needed to designate a site for storage, composting, biogas, etc, or for changing an existing designation to include these activities
- Policies for cost-sharing or financing these initiatives, including projected information from the CCN, and, as they get further, JICA and the UNEP-UTC team, on projected tipping fees for mixed waste in the coming years; also government or other sources of financing
- Policies and standards related to classifying, certifying, and using compost and other produces or materials from the organic waste stream

Products
The product of this scan is a short paper with annexes, one of which is a process flow showing the legal- administrative checkpoints and steps required to register and operate a pilot project legally.

A second valuable annex would be to identify policy areas where the preparation of a policy or briefing paper from the project team would be of use in longer-term sustainable improvement of the organic waste value chain.

Project Meeting
Once the research is completed, it is necessary to organise a project meeting and analyse the results, make a short list of pilot projects, and meet the potential operators. Activities and numbers of days for this are also included.

6.3.5 Quantification and characterisation non-domestic organic waste streams

Based upon the results of organic waste sources inventory (5.3.1) a quantification of the various sources of non-domestic organic waste streams for Nairobi City will be made. This will result will be one of the contributions of this project to the UNEP/CCN inventory.

6.3.6 Formulation of concept sourcing strategies

Based upon the results of the activities in phase 1 of this project a concept for sourcing strategies will be developed and formulated as input in the UNEP/CCN project.

6.4 Implementation and timing of activities Phase 1

In the following table the main implementers of the identified activities in phase 1 are mentioned. Names printed in bold are the proposed project leaders of the activity.

Activities	Implementation	Period (2009)	Completed
1. Inventory Organic Waste Sources	ECMC: **Joyce** and Paul WASTE: Anne Carbon Africa (tentative) Students (tentative)	May – July	July 31
2. Inventory of users, producers and markets for compost and bio-energy	ETC-EA: **Davies** WUR: Kor and Yuca ECMC: Joyce and Paul	May – July	July 31
3. Inventory of solid waste composting, biogas and treatment projects	ETC-EA: Davies ECMC: Joyce and **Paul**	August – September	September 30
4. Analysis of institutional environment	ETC-EA: Davies ECMC: Joyce and **Paul**	August – September	September, 30
5. Quantification and characterisation non-domestic waste streams	ECMC: **Joyce** and Paul WASTE: Anne	August – October	October 15
6. Formulation of concept sourcing strategies	ECMC: Joyce and Paul WASTE: **Anne**	August – October	October 15

6.5 Project Management

LEI, in the person of André de Jager is responsible for the overall project management which includes the following specific activities:

- Organise and chair project meetings (3-4 meetings per year using 'skype' to facilitate participation of all Kenyan and Dutch partners;
- Monitoring and coordination progress of activities;
- Mid-term and end-of-year project report to Dutch Ministry of Agriculture, Nature and Food Quality;
- Liaison to UNEP, NTT, CCN
- Regular informal project updates to Agricultural Counsellor at Royal Netherlands Embassy
- External communication about project in Africa;
- Set-up and maintenance of simple project website

Based upon the results of phase 1 the project management is responsible for the formulation of a detailed workplan of the activities in phase 2. This will formulation needs to be finalized by October 15th. The management will explore the possibilities to implement this formulation during a physical meeting of all the project partners.

6.6 Budget 2009

In the following table an overview of the detailed budget for the activities in phase 1 are presented.

Activities	Unit	LEI Unit price	LEI Number	LEI Total	Alterra Unit price	Alterra Number	Alterra Total	WASTE Unit price	WASTE Number	WASTE Total	ECMC Unit price	ECMC Number	ECMC Total	ETC-EA Unit price	ETC-EA Number	ETC-EA Total	
Phase 1																	
Inception Mission																	
Personnel	day	912	5	4560	912	5	4560	680	5	3400	385	5	1925	275	5	1375	
International travel	ticket	1000	1	1000	1000	1	1000	1000	1	1000							
DSA international staff	day	120	5	600	120	5	600	120	5	600							
Local travel																	
Other																	
Sub-total				**6160**			**6160**			**5000**			**1925**			**1375**	**20620**
Inventory Organic Waste Sources																	
Personnel	day							680	5	3400	385	15	5775				
International travel	ticket							1000	1	1000							
DSA international staff	day							120	5	600							
Local travel													500				
Other																	
Sub-total										**5000**			**6275**				**11275**
Inventory of users compost, bio-energy																	
Personnel	day	736	5	3680	912	5	4560							275	15	4125	
International travel	ticket	1000	1	1000	1000	0	0										
DSA international staff	day	120	5	600	120	0	0										
Local travel																1000	
Other																	
Sub-total				**5280**			**4560**									**5125**	**14965**
Inventory of solid waste treatment projects																	
Personnel	day										385	4	1540	275	4	1100	
International travel	ticket																
DSA international staff	day																
Local travel																	
Other													500			500	
Sub-total													**2040**			**1600**	**3640**
Analysis of institutional environment																	
Personnel	day	736	2	1472				680	1	680	385	2	770	275	2	550	
International travel	ticket																
DSA international staff	day																
Local travel																	
Other																	
Sub-total				**1472**						**680**			**770**			**550**	**3472**
Quantification waste streams																	
Personnel	day							680	1	680	385	4	1540				
International travel	ticket																
DSA international staff	day																
Local travel																	
Other																	
Sub-total										**680**			**1540**				**2220**
Formulation sourcing strategies																	
Personnel	day							680	1	680	385	3	1155				
International travel	ticket																
DSA international staff	day																
Local travel																	
Other																	
Sub-total										**680**			**1155**				**1835**
Total Phase 1				**12912**			**10720**			**12040**			**13705**			**8650**	**58027**
Estimate Phase 2				**7500**			**5000**										**12500**
Management																	
Personnel	day	912	4	3648													
Other				1000													
Sub-total				**4648**													**4648**
Total				**25060**			**15720**			**12040**			**13705**			**8650**	**75175**

Appendix 7 Relevant contacts

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