

LOW COST WASTE INCINERATOR

COUNTRY REVIEW - KENYA

REGIONAL CHARACTERISTICS

Demographic and socio-economic characteristics

Population : 26 million, 26% urban, 48/km⁵

GDP/capita: \$270

Pay levels

Labourers

Junior Managers

Graduate Engineers

Unemployment

Unemployment is substantial. For example, graduates of the university are unable to find skilled work and have to resort to unskilled tasks such as refuse collection.

Climate

The rainfall around Nairobi is about 1800 mm. The dry season is between April and October.

Land use

Land is quite intensively cultivated for agriculture. There are also quite large areas of forest. Making land available for landfills, however, does not appear to present a major problem except near the large cities, where one particular problem is the rapid population growth and urban sprawl. This leads to landfills which were commenced outside cities (e.g. Nairobi, Mombasa) becoming surrounded by housing and squatter settlements.

Water resources

Surface water provides the main source of water supply, although boreholes are used in some rural areas. Waste water treatment is available in the larger cities, but the systems are overloaded. Smaller towns have no treatment facilities.

Industry

General

Kenya has, in regional terms, a significant industrial base, with oil refining, chemical and pharmaceutical manufacture, cement, steel rolling mills, a foundry (Kenya Railways) etc.

Engineering

A number of construction and engineering companies exist

Bricks

Bricks are manufactured but not, as far as is known, refractory bricks.

Materials availability

Mild steel - angle, channel, tube, sheet, plate

Stainless steel

Electrical motors and switchgear

Refractory materials

Manufacture of incinerators

A local incinerator manufacturer exists in Nairobi. A plant was manufactured for the Bata shoe company at Limuru. This plant is of steel construction and has water scrubbing for SO_x.

Technical facilities

The University of Nairobi has all the expected facilities of a significant university.

Air and water testing facilities

The University of Nairobi Chemistry Department carries out air sample analyses - for particulates, SO_x, etc. It can also carry out water sample analysis.

STATUS OF WASTE MANAGEMENT

Waste quantities

There are no statistics for total production of wastes in Kenya. A study on MSW in Nairobi (see below), however, produced the following waste generation statistics:

Source	Quantity	Density CV (KCal/Kg)	
Restaurants	6.79 kg/day	0.28	1630
Other commercial	1.39 kg/day	0.26	1692
High income households	0.654 kg/person/day	0.30	1233
Middle income households	0.595 kg/person/day	0.26	1349
Low income households	0.552 kg/person/day	0.28	630
Markets	2.425 kg/day	0.38	1427
Road sweepings	48.3 kg/km	0.23	n/a
Average		0.28	1032

The difference in CV between low and higher income households is particularly noticeable.

The total MSW production in Nairobi was projected as follows:

Shops and restaurants	94 t/day
Houses	1285 t/day
Markets	82 t/day
Road sweepings	69 t/day

The oil industry estimates that 27,000 tonnes of oil waste are produced from motor vehicles. About 6,000 tonnes is recycled and more is used as fuel.

Waste composition

The same study estimated the composition of MSW as follows:

Material	Average	High income	Low income
Food	51.5%	50%	57%
Paper	17.3%	17%	16%
Textiles	2.7%	3%	2%
Plastic	11.8%	14%	12%
Grass/wood	6.7%	8%	2%
Leather	0.9%	1%	1%
Rubber	1.5%	1%	2%
Glass	2.3%	2%	2%
Cans	1.7%	2%	1%
Other metal	0.9%	1%	0%
Other	2.7%	7%	4%

What is notable is that most beverages are sold in returnable bottles, which accounts for the low proportion of glass and cans. The use of cans is stated to be on the increase. It is notable that the difference in composition between high and low income is not very great. From observation, however, it appears that in many MSW samples, the proportion of dust and fines is substantially greater than shown in the above analysis, which should therefore be treated with caution.

The following information was also calculated:

Moisture	64.2%
Ash	8.9%
Combustible	26.8%
C	49.33%
H	5.45%
N	1.22%
S	0.14%
Cl	0.21%

O 43.75%

Impacts from waste-related pollution

Formal or informal strategies and plans

There is no formal waste management strategy. The Ministry of Environment expressed the view that engineered landfill was extremely expensive.

Existing waste management projects

The World Bank funded the preparation of the National Environmental Action Plan, which contains some aspects on waste management.

JICA funded the preparation of a waste management master plan for Nairobi (A Study on Solid Waste Management in Nairobi City@), which was carried out by CTI Engineering Company Limited and Environmental Technology Consultants Limited (with some participation by Integrated Skills limited). To date, none of the recommendations have been implemented due to lack of available finance.

Organisational arrangements for managing wastes

Municipalities are responsible for managing MSW, including commercial wastes. The private sector handles industrial wastes.

Waste minimisation and recycling

In the major cities, Nairobi and Mombasa, paper, cans, glass and plastic bottles are collected for recycling by private businesses or individuals. There is no such service in the smaller towns.

Some 6,000 tonnes of waste oils are recycled in Kenya, out of a total of 27,000 tonnes. Waste oils are also used as fuel and for wood preservation. The recycling process, however, produces acid tars and the Oil Industry Waste Management Committee are not comfortable with this. They are negotiating for cement kilns to use the oils as secondary fuel. The agrochemical industry have also used cement kilns and are currently negotiating Lomé IV financing to incinerate the existing stockpile of about 100 tonnes. This has been arranged by GIFAP, the international trade association, which has its African headquarters for the Safe Use Programme in Nairobi.

Storage and collection

Individual household waste containers are only present at higher and middle income households. Low income households make use of communal containers or dumping stations - where waste is hand loaded into vehicles. Some dumping stations are constructed of concrete but others are just informal piles, which are sometimes burnt.

The vehicles may be tractor/trailers, open tippers, roll-ons or compaction vehicles, depending on the size of the city. Typical payloads are 2-3 tonnes. Vehicles are not covered and plastic/paper blows away during transit. A study¹ shows that, in 1996, 50% of the Nairobi City Council refuse collection vehicles were non-operational at any one time.

It is estimated in the 1997 JICA study that only some 25% of the waste in Nairobi is collected. In an alternative study, undertaken by UNCHS in 1997¹, however, that 90% is collected. This study assumes daily arisings of 1000 tonnes, against 1530 tonnes in the JICA study. If the JICA figures are used this would give a collection percentage of about 60%. Nairobi City figures for 1996 suggest that 50% was collected. There is little visible evidence to suggest that the JICA figure is correct. The remainder that is not collected is dumped and frequently burnt.

In Mombasa, the mayor took a strong initiative to clean up the city of garbage, but he has recently resigned.

In Nairobi, 60% of waste collection is performed by the private sector, which offers a more reliable service, for which a fee of Ks 200/household/month is charged. Many of these private firms fly-tip the waste. In Nakuru, a charge is made to private collectors for using the city dump. This exacerbates the fly-tipping problem.

In Nairobi, according to the JICA study, the Council collects about 80 t/d of which 91% is from stations and 9% door-to-door. Private contractors collect about 115 t/d split 48%/52%. The UNCHS

¹ Privatisation of Municipal Services in East Africa, UNCHS, 1997

study quotes figures of 400 t/d and 500 t/d. The JICA study contests these figures. The central business district (CBD) collection is contracted out (to Kenya Refuse Handlers Ltd.). Two thirds of CBD industrial waste producers handle their own solid waste, mainly by selling to scavengers.

Disposal methods

There are no controlled landfills in Kenya and complete reliance is placed on open uncontrolled and burning.

The main MSW dump site serving Nairobi is located at Dandora. This is totally uncontrolled and burning. It covers about 26.5 Ha and is estimated to contain some 1.3 million m³ of waste. Many scavengers are present and tannery sludges, hospital waste including used syringes and other industrial wastes can be observed.

The situation in smaller towns is similar, although the proportion of waste collected may be even lower.

Legislation and Enforcement

There is currently no specific legislation on waste management or, yet, on the environment. Kenya currently relies on the Public Health Act (cap 242) and the Local Government Act. Effluent discharge guidelines are set by local authorities. An Environmental Management and Co-ordination Bill received its first reading in Parliament in 1996, but progress has been slow. A new version is to be presented soon but copies are not yet available. It will require EIAs for new developments, will establish a National Environmental Management Agency and will require licensing for waste management facilities. It will also introduce air quality standards but not, we understand, emission standards. It may be published shortly.

Currently, with the lack of legislation, there is little enforcement of waste management standards. Such enforcement as does exist is undertaken by local authorities under the Public Health Act. For example, a waste incinerator at a shoe factory was closed down for production of smoke and a factory discharging heavy metals which caused a sewage works to cease functioning was closed down until a treatment plant was constructed.

The Ministry of Environmental Conservation consists of three sections: Mines and Geology, Forestry and the National Environmental Secretariat. The Secretariat covers pollution control (wastes), EIAs, resource management, planning and education.

There is currently no formal consultation about the location and operation of dump sites. They are selected by the municipal authorities. The EIA procedure will alter this when it is introduced.

Under the new legislation, it is expected that monitoring of discharges to ground and surface water would be undertaken by the Ministry of Land Reclamation, Regional and Water Development (MLRRWD). It might, however, be delegated to the local authorities.

SPECIFIC SITUATIONS

Nakuru

Nakuru is a city of about 250,000 inhabitants, some 150 km north of Nairobi, in the rift valley. It relies extensively on dumping stations in the low income areas. The dump site is on the edge of the town. It has no staff or any control. The City is believed to be technically insolvent,

Machakos

This City, of about 100,000 inhabitants, showed no interest whatever in participating.

Limuru

This town, about 25 km North of Nairobi, has some 30,000 inhabitants and has a predominantly agricultural economy, although there is also a Bata shoe factory and a number of sawmills. The

Council appear to be interested in participating and the town was recommended by the Ministry of Environment.

The dump site is about 6 km outside the town in a forest, well away from housing. The waste volume appears very low - probably well below 10 tonnes/day (because of the poor collection service) - and contains a significant amount of dust, although there is also quite a bit of plastic.

Collection trips consist of 7 trips a week each by a tipper and tractor/trailer. The latter appears to have a payload of about 1.5 tonnes. If the tipper does 3 tonnes, this gives a total of about 30 tonnes a week.

There is also a Bata shoe factory which has its own incinerator. This is currently shut down by the council for making too much smoke. The plant was designed (?) And built by a local firm in Nairobi. It is of steel construction and has water scrubbing - to remove SO_x and NO_x. They are currently making some changes and hope to get it going again, as they are very short of landfill space. They have recently required operators to wear smoke masks. The plant is, however, situated in a valley which is subject to inversions. The waste from this plant has been analysed.

There are also several small sawmills, which have surplus sawdust.

GOVERNMENT ATTITUDES

Importance attached to waste management standards

MSW management is regarded as a major problem by the Ministry of Environmental Conservation. Whether it, or even the environment in general, is seen as a national priority, however, is more questionable.

What is clear, from the activities in Mombasa, is that there are votes in good MSW management.

PUBLIC PERCEPTIONS AND ATTITUDES

Level of concern about waste management

It appears that people are concerned by the inadequate management of MSW and the continuing decline in standards. In Nairobi, a survey showed that 36% of respondents thought that the problem of garbage collection was very serious and a further 22% saw the problem as moderate. If people are to be expected to pay for a service, however, the quality - particularly of collection - must be dramatically improved. It is unlikely that low income groups will be prepared to pay anything for such a service.

Level of concern about incineration

The Ministry of Environment showed some concern about the location of an incinerator and feared that the sight of a chimney near to housing might cause public opposition.

NGOs

The main environmental NGO is the Kenya Energy & Environment Organisation (KENGO). This NGO is active, mainly in the energy sector, but is also interested in waste management.

FINANCIAL ISSUES AND CONSTRAINTS

Arrangements for financing and recovering the costs of waste management

Nairobi City currently charges about Ks 20/household/month for waste collection and a similar amount is charged in Mombasa. The private sector charges ten times this amount or more - and yet a

significant proportion of households make use of the private sector. The Nairobi master plan provides for full cost recovery, but no attempt has yet been made to increase the charges - largely because it is expected that no one will pay unless the collection service quality is improved first.

Role of private sector

In Nairobi, there are three significant operators. These are Kenya Refuse Handlers (KRH), Domestic Refuse Disposal Services Limited (DRDSL) and Bins (Kenya) Limited. There are also about 30 smaller companies, which operate completely unregulated and are believed to dispose of much waste illegally.

A survey carried out in Nairobi¹ showed that 78% of respondents thought that privatisation would improve waste management services.

Attitudes to increasing expenditure on waste management

The municipalities are generally bankrupt. For example, in Nairobi, the Electricity supply company has ceased to supply the City, which has installed its own generator. In 1995/5 the City managed to collect 65% of the rates due - declining from 90% in 1991/2.

Mombasa, on the other hand, has made significant efforts, largely because of the importance of the tourist trade. Smaller towns seem to have a greater inclination to do something positive.

The Ministry states that municipalities will pay for better MSW management.

A survey¹ of residents of Nairobi has shown that 47% of those paying Ks 100/month or less would be prepared to pay more than Ks 200/month for good waste management services. 50% of those paying Ks 300-400 indicated a willingness to pay up to Ks 800/month.

COMMITMENT TO PROJECT

Central Government

The Ministry have declared an interest in the project (in writing), although they clearly recognise that it is not the answer to their MSW problems.

Local Government

Nakuru showed an interest, although the size, location and financial status of the City are far from ideal. Limuru also showed an interest, although the senior officials were not present.

POTENTIAL PARTNERS

The incinerator manufacturing company would seem to be an ideal partner.

