“To Make the Planet Greener”

Global Proposal Project Kenya

Waste management Nairobi and Dandora dumpsite

MPI-WH/TK – 29112007

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Table of Content:

APPENDICES

Management Letter

Multi Purpose Industries' vision is that former dumpsites can be used in a much more profitable and sustainable manner. By means of a full scale sanitation the areas involved can be used for the creation of new developments such as industrial estates, living estates, recreational grounds and so on. In the process reusable materials such as metals, glass, plastics, and so on will be reclaimed and recycled to the industry. Organic waste components will be transferred into energy and basic minerals for agricultural use. The Multi Purpose Industries Concept or Innovative Waste Mining will contribute to a sustainable solution for dumpsites and the growing production of waste in daily life on an economical sound and environmental acceptable base.

The Multi Purpose Industries business principle is primarily based on sanitation of former and active dumpsites worldwide. MPI's strength (USP) in relation to other techniques and approaches is the fact that the specific combination of technologies involved to solve the actual problem at hand can be operated on an economical more profitable way with less initial investments per project.

In order to reach the maximum output in all respects (technical, economical, social, environmental) a large number of scientific institutions in The Netherlands contribute to each project with their support, research and project involvement by actual studies and research performed by their employees and students.
Multi Purpose Industries also maintains a very close cooperation with a number of official governmental organizations, private investment companies, international banks, private companies and environmental organizations.

The additional value of the Multi Purpose Industries approach on the daily waste production worldwide as well as on the so called historical waste load (former dumpsites) is basically a new way to create a better future for us and for generations to come by using all available techniques and those to be developed in the process to the maximum in both an environmental and economical most suitable, sustainable and profitable way. This as an addition to the "Cradle-to-Cradle" philosophy by Prof.Ir Braungart.
Other then the usual approach Multi Purpose Industries uses the value of the reclaimed/recycled materials, the land and the generated energy to create an economic acceptable business case.
Due to these approach gate fees for process able materials delivered at the Multi purpose Unit will not be asked. Hence fees involved in collecting waste can be used to improve the collecting system and support new developments in local transportation- and handling techniques.
"Fresh" delivered waste contributes to the process of sanitation of existing dumpsites. Part of the energy generated can be directly used as the "engine" or "energy source" for the sanitation process.

The options as formulated in this global proposal on a sustainable solution for Kenya's waste management and the sanitation of Dandora dumpsite may lead to a fruit full cooperation between Kenya and Multi Purpose Industries. There for we ask the government of Kenya to facilitate a positive continuation of this project proposal.

Multi Purpose Industries management is very interested to be informed about the decisions related to these issues made by the Kenyan Government and the City Council of Nairobi.

Oldenzaal, The Netherlands
December 2007

Wim Hoppenreijs
Multi Purpose Industries
Managing Financial Director

Ton Koens
Multi Purpose Industries
Managing Technical Director

Multi Purpose Industries

Multi Purpose industries (MPI) is a venture that focuses on sustainable conservation. As a consortium of innovative companies, MPI is constantly searching for integrated solutions to various problems concerning the environment.

Points of Interest

MPI is active in the areas of waste disposal, sanitation of landfills and contaminated soil, and conversion of waste material into energy and useable materials. The Multi-Purpose Unit (MPU) is a good example of a total approach. Our MPUs fully convert all kinds of waste material into useable residual material and energy in a confined space.

Sustainable Conservation

The total 'Multi Purpose Industries' concept is based on a unique collaboration between the business world, governments, academic institutions and training centres, as well as local and regional environmental management. After all, real environmental improvement can only be achieved if all these stakeholders work together towards sustainable conservation. In line with this, MPI provides a very innovative link between various existing isolated technologies. The resulting chain structure leads to returns that are much higher than what the individual technologies can yield on their own. This maximises profit both for the environment and for our clients.

Patent Pending

The unique 'Multi Purpose Industries-concept' patent is pending under number N2000759.

Sustainable profit

MPI is constantly searching for sustainable, economically sound and integrated solutions for pressing environmental problems. Currently, MPI heavily focuses on issues relating to waste. This has become a preoccupation both for the economy, the environment and society. MPI can provide a solution with a high and sustainable return to all of these problems, whether they concern landfill sanitation or industrial waste management. This characterises the innovative power of MPI and, at the same time, proves that sustainable environmental management and economic interests can go together.

Economy

The manner in which MPI handles landfill sanitation reflects the desire to link maximum environmental performance to optimal economic returns. Former landfills are generally avoided by developers of urban spaces. Reclaiming landfills for agricultural use is usually out of the question for reasons of food safety. Thus, landfills have little economic value. Landfill sanitation leads to high economic returns, certainly in areas where former landfills are standing in the way of planning developments. In addition, each unit directly creates substantial opportunities for employment, namely, up to 60 jobs for a minimum period of 5 years.

From burden to benefit

In addition to this collective advantage, MPI's treatment methods lead to direct benefits for contracting parties and participants in the immediate vicinity of the production of our installations. Not only can they deliver waste products to the MPI treatment units under more favourable conditions, but they also receive inexpensive energy and new raw materials in return. This is exactly what MPI does: turning waste from a burden to a benefit.

Environment

Achieving optimal returns for our environment is at the core of MPI's mission. The Multi Purpose Units' approach to waste treatment can considerably ease the strain on the required dumping capacity in the world. After treating waste in the MPUs, hardly any material is left that needs to be dumped. This is the result of the closely linked treatment processes and the standard recycling quota of 70 percent. The average quota for regular waste treatment is about 45 percent.

Minimal waste transport

The local collection and treatment of waste minimises the need for transport. Emissions resulting from the transport of waste are drastically reduced. This also cuts fuel costs. Environmentally friendly fuels are an important end product of the treatment process in our MPUs. Companies and private individuals living in the vicinity of an MPU can fill up with such fuels as synthetic natural gas, synthetic diesel, biodiesel, methanol, and soon, even hydrogen.

For additional information see our Website: www.mpi-group.eu

MPI is the first organisation to offer a total solution for landfill sanitation – Waste mining

Multi Purpose Industries (MPI) has developed an innovative and patented concept in the field of waste-mining to sanitise old landfills. The concept focuses on sanitising landfills using an integrated approach and optimising reuse of landfill contents in the form of energy and reusable raw materials. The concept is unique in the world both in technical and economic terms. It is based on modern, proven, and often highly specialised separation and treatment technologies which are combined to form a controllable and flexible small-scale closed chain structure.

After digging up the landfill contents on the site, the production process meticulously sorts out and separates all recoverable raw materials (metal, glass, building materials etc). Then, the flows will be processed in order to meet the purchasing specifications of the market. During these processes, a large amount of energy can be produced out of worthless but exploitable residual materials (such as biomass)[1]. Likewise, synthetic natural gas and diesel oil can also be produced and sold. Toxic or harmful non-usable substances are destroyed on site. Finally, the fully sanitised clean land can be used for new purposes, such as residential developments, business parks, recreation and agriculture.

The competitive edge of the MPI concept over the current approaches to landfill management can be summarised in 10 points:

1. The waste materials and the land (ready for building) have value, and not the transport and the treatment in themselves.
2. MPI creates a demountable treatment chain which can be built on or right next to a landfill. This implies a considerable reduction in the logistical burden and operational costs.
3. Through the adoption and innovative combination of ultra-modern, small-scale and thus flexible technologies, MPI can guarantee a higher degree of efficiency than what can be achieved by current sanitation methods.
4. Efficiency can further be improved by means of a selected input, i.e. the output of combinations of separation technologies used as a conditioned input for various treatment technologies.
5. MPI can achieve a recycling quota of about 70% for usable materials. This is much higher than in current methods for dealing with landfills.
6. Non-usable substances (such as biomass), the remaining 25-30%, will be converted into energy.
7. Toxic and harmful substances (0-5%) are destroyed on site or permanently immobilised.
8. MPI provides a *close to zero emission* production process, which may create opportunities for emissions trading.
9. MPI carries out full and integrated landfill sanitation. The only material that will be brought back is sanitised soil.
10. By fully sanitising a former landfill, MPI creates enormous added value for space planning.

MPI Waste-mining offers a landfill sanitation concept that is better than the current approach in all cases.

Depending on the size and composition of the landfill, as shown by feasibility studies, sanitation following this waste-mining concept can be profitable (large, relatively new landfills), cost-neutral (landfills of an average age, composition and size) or loss-making (old, small landfills that are organically worked out but contaminated with industrial waste).
However, in all three cases, the MPI concept is much more cost-effective than the current approach, which is usually excavating, physically separating any lucrative materials, and then transporting the rest elsewhere to be restored and/or incinerated.

[1] Based on an average landfill composition, about 21.5 MW of heat and electricity can be produced, of which 6 MW is green electricity. Approximately 9 MW is needed for internal use; most of the energy can be delivered to local industries and/or the mains.

MPI's approach to waste mining has a very good chance of succeeding for the following reasons:

- The integrated landfill after-care in line with the MPI's approach is preferred by relevant policy-makers.
- There is an urgent need for a sustainable approach to landfills.
- Government and society call for an increased production of green electricity and increased use of reusable raw materials in the production process.
- Waste treatment installations do not have sufficient capacity to incinerate the rising waste volumes, while incombustible waste materials continue to be dumped on landfills.

MPI's approach for Kenya

History:

Several potential stakeholders from Kenya have approached MPI to investigate the possibilities to develop an acceptable solution for the environmental- and waste problems in Kenya.

Due to several official guidelines from the Kenyan Government as stated in the publications: *"Vision Kenya 2030"* and *"the City of Nairobi Environmental Outlook"*
a sustainable solution for the environmental- and waste problems in Kenya must be developed and implemented as soon as possible.

Also *the "Request for Proposal on improvement of Dandora Waste Disposal Site"* by the City Council of Nairobi has emphasised the urgency to find sustainable solutions.

As a result of these events Mr. Wim Hoppenreijs, Managing Financial Director of The Multi Purpose Industries Group of Companies has visited Kenya in November 2007.
The various contacts in and around Kenya and the official organizations like the European community, the Embassies, the United Nations and so on have led to this document: "A global Proposal on a sustainable Solution for the environmental and waste problems in Kenya".

The intention of this document is to reach an agreement with all the stakeholders involved to set up a first pilot-project in Kenya.

The Environment: (Kenya Vision 2030)

Kenya aims to be a nation living in a clean, secure and sustainable environment in 2030. The goals for 2012 are: (i) to increase forest cover from less than 3% at present to 4%; and (ii) to lessen by half all environment-related diseases.

Specific strategies involve: promoting environmental conservation for better support to the economic flagship projects and for the purposes of achieving the Millennium Development (MDCs); improving pollution and waste management through the design and application of economic incentives; and the commissioning of public-private partnerships (PP improved efficiency in water and sanitation delivery.

The total range of Multi Purpose Industries activities contribute in all respects to the environmental vision as mentioned above. All activities result in direct and indirect jobs, new technical development, education and knowledge transfer in the region and numerous related spin-off's, a boost in the local economy, considerable reduction in pollution, improved material-, energy-, and waste management in the region and last but not least new public-private partnerships to accommodate the wide variety of activities originating from the Multi Purpose Industries Concept and her developments.

Multi Purpose Unit Technology:

A Multi Purpose Unit basically consists of the following systems:

- Receipt/registration and loading/unloading unit as well as weighing facilities.
- systems for manual and mechanical separation and cleaning of materials
- sorting lines
- storage systems (for collecting and storing materials)
- volume reduction systems (melting, pressing, dismantling, shredding and the like)
- drainage systems (e.g. for distillation and lyophilization)
- conversion systems (chemical reaction, fermentation facilities, composting, inert binding)
- gasification systems (energy production, volume reduction)
- sanitation systems for organic and mineral sources
- production units (for demineralised water, distilled water, drinking water as well as for new products: such as furnace blocks, packaging material, timber etc.)
- and so on

Every waste problem is unique. In some cases, a lot of material is suitable for recycling, while in some cases, it is a matter of sanitising soil or converting substances that are hard to decompose into energy. MPI therefore works towards a custom solution for each specific waste problem. This means that no two M.P.U.'s are alike, even though the basic concept is always the same. All M.P.U.'s consist of an extensive treatment chain linked by various proven technologies.

All systems involved are equipped according the latest technical standards an proven in long term practical use. Because every Multi Purpose Unit is basically a "building box" every specific local problem can be addressed with the most suitable techniques in a very efficient manner.

Multi Purpose Industries solution for the current waste collection/ recycling/ dumping of the daily-generated waste:

From all the solid waste generated in Nairobi, only 40% is collected by the City Council, and an other 20% by sixty private companies. The rest are either left uncollected, or are disposed of by other means. Including by burning, dumping in pits and other unauthorised places.
Most of the collected waste is dumped on Dandora.

Now the dumpsite of Dandora has reached its full capacity. Therefore new landfills must be developed or alternate solutions be implemented.
The problems with the waste collection and dumping are complex.
Not only the environment, but also the people living in the area of Dandora are involved. Nearly 250.000 people living in the area and direct or indirect are dependent of the dumpsite. Closing Dandora will directly affect this people.

A massive problem for developing new dumpsites is the cost for collection and dumping of the waste. Increasing the price for collecting waste will in effect also increase the illegal dumping.

Since over 50 per cent of the waste generated is organic, Multi Purpose Industries claims, that it is possible to process the waste totally in a profitable way, **without asking a gate fee**.
In our close to zero emission unit we can produce an amount of energy or energy carriers, with an economic value, large enough to cover the expenses of a Multi Purpose Unit.
The entire fee for collecting the waste can be used for rapidly improving the waste-collection system.

An option for starting sanitising Dandora

Because a Multi Purpose Unit produces besides biogas, bio-oil, green coal and electricity, also a lot of heath, this energy can be used to clean up old landfills according the MPI-concept.
However using this energy in internal processing will decrease the revenues from a MPU.
Depending on the way of cleaning Dandora, the amount of pollution and the speed of processing a suitable balance must be acquired without creating economical losses.
Over 600 people now living on Dandora, can be employed in one M.P.U. directly. Considering spin-off's and indirect jobs, you can multiply this number with a factor three.
After cleaning the first section of the landfill, a start can be make for housing and urbanisation.

Housing and Urbanisation: (Kenya Vision 2030)

The 2030 vision for housing and urbanization is an adequately and decently housed nation in a sustainable environment. The goal for 2012 is to increase the annual production of housing units from the current 35,000 annually to over 200,000.

Kenya's cities and towns are poorly planned. There is an acute need therefore for an effective capacity for regional and urban development planning. In addition, there will be better development of and access to affordable and adequate housing; enhanced access to adequate finance for developers and buyers, and pursue targeted key reforms to unlock the potential of the housing sector.

Multi Purpose Industries can generate a substantial contribution to reach the aim of new

housing units, by implementing the issue of housing MPI's workforce in housing units on the several projects.
The housing Units consist basically of a concrete/brick housing block containing:
1 standard living quarter, 1 standard kitchen/bathroom/shower unit and 2 sleeping quarters. The larger units contain 4 sleeping units.
Every unit is standard equipped with minimal 1 electric light point per room, 1 standard electrical connection box per room, drinking water tap in the kitchen unit, sewage connection to kitchen, washroom/shower and toilet. A fruit- and vegetable garden of 15 m2 per housing unit equipped with 1 water tap, 1 sewage connection and 1 standard electric connection box will also be developed.

After the completion of the several landfill- or dumpsite sanitation projects the meanwhile developed housing units, school- and hospital units will remain in working order and might be transferred to the state of Kenya (BOT).

WATER AND SANITATION: (Kenya Vision 2030)

Kenya is a water scarce country. The country therefore aims to conserve water sources and start new ways of harvesting and using rain and underground water.

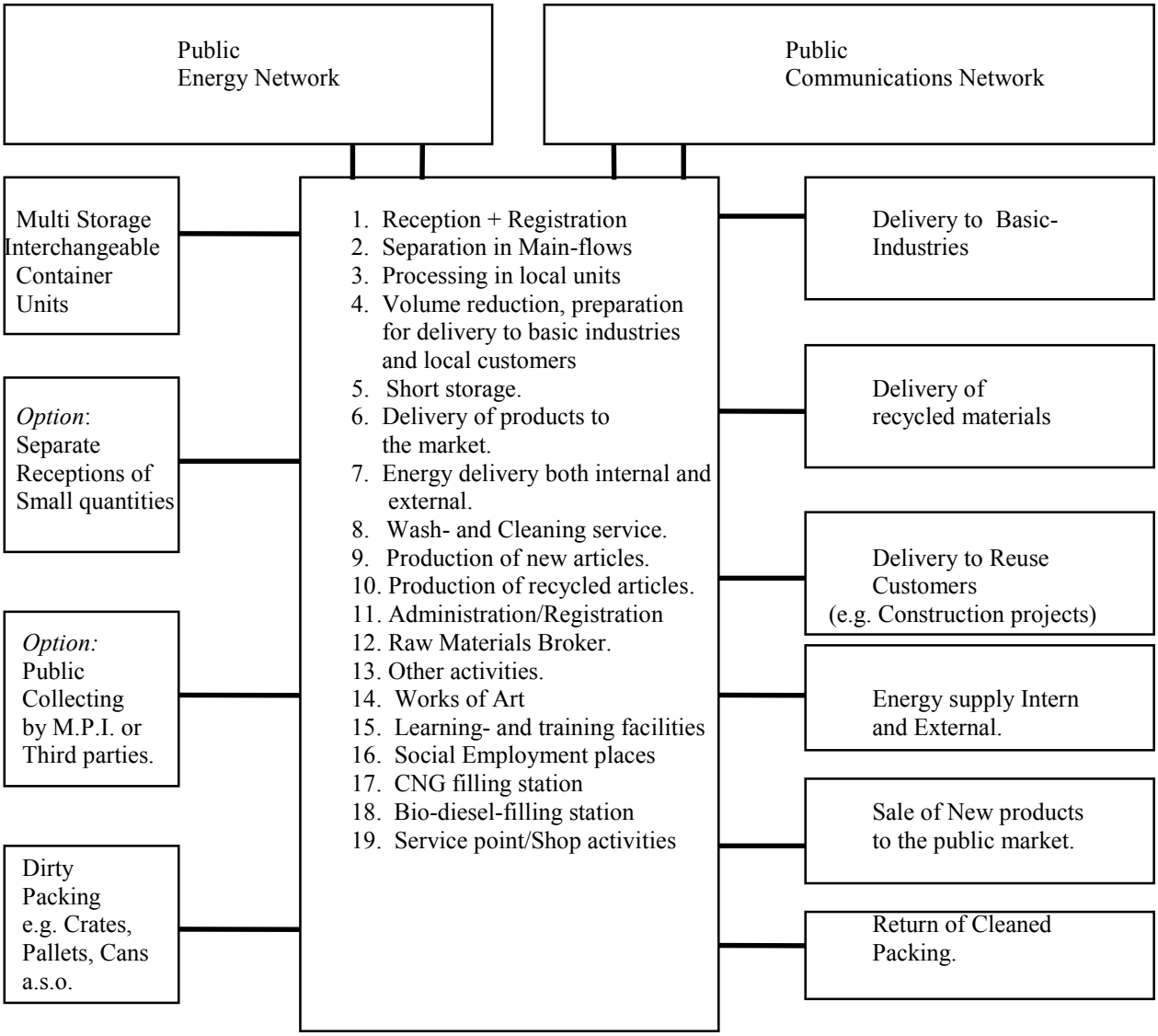
The 2030 vision for Water and Sanitation is to ensure that improved water and sanitation are available and accessible to all.

The goal for 2012 is to increase both access to safe water and sanitation in both rural and urban areas beyond present levels. To promote agricultural productivity the area under irrigation and drainage will increase from 140,000 to 300,000 hectares. Specific strategies will be introduced to raise the standards of the country's overall water resource management, storage and harvesting capability.

Multi Purpose Industries can deliver a substantial contribution to reach the aim of new sources of drinking and potable water.
Every waste-mining or landfill sanitation project performed on the M.P.I.-concept base produces minimum up to 40.000 litres per day of high quality drinking water according to Dutch National and Legal standards from local waste percolate-, surface- and underground water.
In case of nearby availability of salt water an MPU-unit can produce minimum up to 25.000 litres per day from salt water of high quality drinking water according to Dutch National and Legal standards.
Multi Purpose Industries also provides the opportunity to start up water-projects sec. Meaning not directly related to waste mining and/or landfill sanitation, waste processing and so on.

Multi Purpose Industries
(An environmental responsible and profitable philosophy)

Multi Purpose Unit - Schematics:



Ton Koens
CTO – MPI
27-09-2007

List of relevant Stakeholders in Kenyan Projects:

Ministry of Planning and National Development of Kenya
The National Economic and Social Council of Kenya (NESC)
City of Nairobi

Mr. A. Muusya Mwinzi,	NEMA	Director General
Cllr. Charles Kiyo Muratha	City Council Nairobi	Deputy Mayor
Mr. J. Chege Maina	Ministry Treasury	Head External Resouses
Prof P. Mbithi	University Nairobi	Deputy Vice Chancellor
Dhr. B. Rozeboom	Global Plastic Recycling	Eigenaar Director
Dhr. M. Barel	Undp	Consultant
Mr. Francis Thuku	Alpha Net LTD	Managing Director
Dr. A. Kamenyi	EPC Consult. Int.	Maniging Director
Lornah Kiplagat	Lornah Kiplagat Foundation	Owner
Mr. G. Besseling	Jenga Africa Ltd	Managing Director
Dutch Embassy in Kenya	Mr. M. Dadema	Environmental Coördinator

Dutch Ministry of Economics, The Hague
Dutch Ministry of Environmental Affairs, The Hague

Multi Purpose Industries

Multi Purpose Industries' Consortium Partners (Technical):
e.g. Host Engineering BV
Bio Mass Technology Group BV
Stork Power Systems
Dutch Four Gas sytems
Van Bemmel Soil Handling Systems
Bollegraaf BV Sorting- and Compacting Systems
Maxon Motors International
Riwo Engineering BV
Etc.

Multi Purpose Industries' Scientific Partners:

e.g.	Technical University of Twente	TU-twente
	Technical University of Eindhoven	TUe
	Technical University of Delft	TU-delft
	University of Groningen	RUG
	Wageningen University	WUR
	Energy Centre of The Netherlands	ECN
	TNO Life Sciences	TNO
	Hogescholen Saxion	Saxion – Enschede/Deventer
	Deltion College	Deltion – Zwolle

Multi Purpose Industries' Financial Partners and Advisors:
e.g. RaboBank International Corporate Clients
Fortis Intertrust International
Price Waterhouse Coopers
Credion Apeldoorn BV CCN
Dynova BV International Subsidizing advicers
Kienhuis Hoving, Lawyers and Barristers
Van Kessel, Lawyers
EcoSphere, Marketing and International affairs

Financial:

Investment needed to install all the necessary equipment, installations and tools for the suitable Multi purpose Unit, able to cope with the waste as mentioned in the several discussions and meetings, to get a start for a sustainable solution for the Nairobi Waste Issue: € 45 to € 50 Million.
According to Multi Purpose Industries calculations on projects of roughly the same magnitude we are convinced to reach a return on investment (ROI) within 5-7 years.

Based on Multi Purpose Industries experiences worldwide so far, we consider an annual profit of € 4 to € 5 a feasible result.

Due to Multi Purpose Industries environmental and social approach the mayor part of the profit made in the related project will be reinvested locally to improve economical, social en environmental conditions. Following the People, Planet, Profit principle also makes a difference for this specific project.

Funding:

The initial € 45 to € 50 Million must be brought together by the State of Kenya, the City of Nairobi, the European Union, International Organizations (NGO's), The Netherlands, Multi Purpose Industries, the mentioned stakeholders and private investors. Broad support and commitment is absolutely required to be able to realize this unique project.

Next Steps:

If the initial commitment by the Kenyan Government and the City Council of Nairobi is issued a conference meeting including all the different stakeholders and related organizations must be organized.

Depending on the results of this meeting a suitable time path must be drawn up to be able to get things started as soon as possible.

The first action to be settled to pave the way to the full operational Multi Purpose Unit and a success full project overall is a feasibility study at the locations involved. This study includes basically two main options:

1. A stand-alone Multi Purpose Unit specifically for processing and recycling the daily produced waste from the areas involved. Estimated costs € 350.000,--, and

2. A combination Multi purpose Unit for both processing and recycling the daily produced waste from the areas involved as well as processing already dumped waste.
   For example Dandora dumpsite. Estimated costs € 950.000,--

Option 2 is the most preferable because this will have the largest direct impact on economical and social daily life as well as on the environmental conditions in the areas involved. This option also will be supported by all the international organizations involved.

Because the cost involved in the feasibility studies are accounted for in the total project investments the initial cost will be returned if the official order is given.

WH/TK 301107

“To Make the Planet Greener”

Appendix I

Presentation of innovative landfill waste-mining

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Multi Purpose Industries®

innovative landfill waste-mining

An introduction

Contents

Multi Purpose Industries® - MPI

MPI is a consortium of businesses working with the Technical Universities of Enschede and Eindhoven, Wageningen University and Research Centre and the Saxion Polytechnic University of Enschede.

Our affiliated scientists include Prof. C. Daey Ouwens † (TU Eindhoven), Dr. W. Gilijamse (Saxion University), Prof. J. Sanders (WUR).

MPI's Vision

Innovative waste-mining can offer a total sustainable and economically sound solution to the unresolved landfill issue* and the rising waste volumes*.

* See background information nos. 11-12 and/ or position paper: www.mpi-group.eu

Objectives 2008

(I) Launch a pilot-project to prove that a total sustainable and economically sound solution to the landfill issue exists.

(II) Launch a number of projects to prove that the rising waste volumes can be processed in a more lucrative and sustainable manner.

Innovative landfill waste-mining (I) - 8 basic principles -

1- Economically sound approach*

> or instance, by using returns yielded by profitable processes to finance unprofitable processes

2- The existing flows of waste are treated on site

3- The approach is based on the principle of zero emission

4- The approach focuses on the full sanitation of the land

* Based on the average landfill composition, as described in the reports on Former Landfill After-care Recommendations (NAVOS – Advies Nazorg Voormalige Stortplaatsen), April 2005, and Background Information on the NAVOS, April 2005.

Innovative landfill waste-mining (II)
- 8 basic principles -

5- Useable materials are reused as industrial raw materials (building materials, metals, glass etc.). Non-exploitable materials, such as biomass, are converted into energy or energy carriers
  - Green electricity, “Green coal”, biogas en biofuel

6- Any toxic substances encountered are destroyed on the site

7- Capacity of 500.000 MT/ A

8- Possible delivery of land ready for building and new uses, including residential developments

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The technical concept

Various technologies* are used on the landfill site, depending on the waste composition and other factors
  – Standard chain of 22 “boxes”, which can be extended with 30 additional boxes depending on the landfill

The combination of the sub technologies** is implemented in a unique way, i.e. on the smallest scale possible with the highest possible efficiency and flexibility.
  – Output box 1 → Input box2 ; Output box 2 → Input box 3 etc.

The innovative sub technologies have ‘proven records’**

* Technologies: digestion systems; gassification systems; water purifying; syngas engines, biogas engines, elektric installations; steam generator; sorting installations; pyrolyses installations (several concepts), shredders, compactors, crushers, granuleting systems, washing systems, distillation systems.

** The innovative chain of technologies has been tested ‘small scale’ by Biomass Technology Group, Enschede. The sub technologies are proven by well known institutes like: TU Delft, TU Eindhoven, TU Twente, ECN.

Advantages MPI concept (I)

Economics

- About 70% reused as raw materials
- Non-usable raw materials (about 25-30%) are converted into green energy (21MW) and/or energy carriers
- Added value for space planning created on former landfill
- Spin-off for additional activities
- Local subcontractor deliveries
- Attracting peripheral flows of waste, such as industrial waste

Environmental-technical

- Full sanitation of landfills, nothing will be redumped
- Toxic and harmful substances (about 0-5%) are destroyed on site or permanently immobilised

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Advantages MPI concept (II)

Social

- About 75 FTEs per Unit
- About 10 internship learning and education positions
- Knowledge development

If the sorting processes are mainly performed by hand the number employees involved may increase up to 600 FTE's.

www.mpi-group.eu

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Landfill issues in The Netherlands (I)

(NAVOS rapport, April 2005)

- 4000 Landfills - 8000 ha.
  - In about 30% of the landfills, the groundwater and surface water are highly contaminated
  - In about 90%, the cover layer does not meet regulations
  - Potential increase in landfill gas emissions (Kyoto)
  - Potential contamination of properties surrounding the landfill site
  - Potential exacerbation of groundwater contamination
  - Most are inactive and “invisibly” covered with sand
  - Current after-care: Regular monitoring and maintenance of the cover layer
  - Annual monitoring costs € 200,000 euros per landfill on average

Landfill issues in The netherlands (II)

(NAVOS, April 2005)

- 570 landfills in urban areas
  - 350 landfills stand in the way of planning, environment-technological and/or economic developments
  - 700 ha with potential added value for space planning
    - Industrial area: 700 M€
    - Residential developments: 2800 M€

Waste: a growing mountain

- Approximately 10 million MT was treated in the Netherlands in 2005.
  - About 6 million MT processed by means of incineration & recycling activities
  - Energy yield from incineration is about 22%
  - New systems to be built > 27%
- Due to insufficient incineration capacity, about 4 million MT is dumped in 10 landfills
  - Dumping costs approximately 480 million €/ year
  - About 400,000 trucks deployed

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Appendix II

Introduction Multi Purpose Industries

(in The Netherlands)

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The issue of landfills in the Netherlands

The Netherlands has about 4,000 (closed) landfills (8,000 ha), in which various types and compositions of waste (chemical waste, bulky household refuse, white and brown goods, household residual waste etc.) have been dumped over the past decades. Perpetual after-care for former landfills is mandatory in the Netherlands. This mandatory perpetual care can be of an environmental-hygienic, social and/or economic nature. Ten percent of the landfills are either located in areas which are needed for urban development or industrial use, or pose an environmental and hygienic risk, e.g. serious contamination of groundwater with leachate[2].

Only costly partial solutions, such as transferring, removing and covering waste, have hitherto been provided to deal with the risks posed by these 'problem landfills'. For landfill owners – often the municipalities – landfill sanitation carries a high price tag (€ 140 up to more than € 200 per ton).

MPI is the first organisation to offer a total solution for landfill sanitation - Waste-mining

Multi Purpose Industries (MPI) has developed an innovative and patented concept in the field of waste-mining to sanitise old landfills. The concept focuses on sanitising landfills using an integrated approach and optimising reuse of landfill contents in the form of energy and reusable raw materials. The concept is unique in the world both in technical and economic terms. It is based on modern, proven, and often highly specialised separation and treatment technologies which are combined to form a controllable and flexible small-scale closed chain structure.

After digging up the landfill contents on the site, the production process meticulously sorts out and separates all recoverable raw materials (metal, glass, building materials etc). Then, the flows will be processed in order to meet the purchasing specifications of the market. During these processes, a large amount of energy can be produced out of worthless but exploitable residual materials (such as biomass)[3]. Likewise, synthetic natural gas and diesel oil can also be produced and sold. Toxic or harmful non-usable substances are destroyed on site. Finally, the fully sanitised clean land can be used for new purposes, such as residential developments, business parks, recreation and agriculture.

The competitive edge of the MPI concept over the current approaches to landfill management can be summarised in 10 points:

1. The waste materials and the land (ready for building) have value, and not the transport and the treatment in themselves.
2. MPI creates a demountable treatment chain which can be built on or right next to a landfill. This implies a considerable reduction in the logistical burden and operational costs.
3. Through the adoption and innovative combination of ultra-modern, small-scale and thus flexible technologies, MPI can guarantee a higher degree of efficiency than what can be achieved by current sanitation methods.
4. Efficiency can further be improved by means of a selected input, i.e. the output of combinations of separation technologies used as a conditioned input for various treatment technologies.
5. MPI can achieve a recycling quota of about 70% for usable materials. This is much higher than in current methods for dealing with landfills.
6. Non-usable substances (such as biomass), the remaining 25-30%, will be converted into energy.

[2] The risks posed by landfills are described in detail in the reports on Former Landfill After-care Recommendations (NAVOS - *Advies Nazorg Voormalige Stortplaatsen*), April 2005, and Background Information on the NAVOS, April 2005.
[3] Based on an average landfill composition, about 21.5 MW of heat and electricity can be produced, of which 6 MW is green electricity. Approximately 9 MW is needed for internal use; most of the energy can be delivered to local industries and/or the mains.

7. Toxic and harmful substances (0-5%) are destroyed on site or permanently immobilised.
8. MPI provides a *close to zero emission* production process, which may create opportunities for emissions trading.
9. MPI carries out full and integrated landfill sanitation. The only material that will be brought back is sanitised soil.
10. By fully sanitising a former landfill, MPI creates enormous added value for space planning.

MPI Waste-mining offers a landfill sanitation concept that is better than the current approach in all cases.

Depending on the size and composition of the landfill, as shown by feasibility studies, sanitation following this waste-mining concept can be profitable (large, relatively new landfills), cost-neutral (landfills of an average age, composition and size) or loss-making (old, small landfills that are organically worked out but contaminated with industrial waste).
However, in all three cases, the MPI concept is much more cost-effective than the current approach, which is usually excavating, physically separating any lucrative materials, and then transporting the rest elsewhere to be redumped and/or incinerated.

MPI's approach to waste-mining has a very good chance of succeeding for the following reasons:

- The integrated landfill after-care in line with the MPI's approach is preferred by relevant policy-makers.
- There is an urgent need for a sustainable approach to landfills.
- Government and society call for an increased production of green electricity and increased use of reusable raw materials in the production process.
- Waste treatment installations do not have sufficient capacity to incinerate the rising waste volumes, while incombustible waste materials continue to be dumped on landfills.

Further information: www.mpi-group.eu

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Appendix III

Introduction waste mining

(in The Netherlands)

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The objective of Multi Purpose Industries

Former landfills are a matter of concern in the Netherlands. The risks involved are of an environmental, hygienic, social and economic nature. The issue concerns 4,000 landfills (8,000 ha), of which 350 are in areas which are actually needed for urban development or industrial use (700 ha).
With its mission to help minimise the above risks, Multi Purpose Industries (MPI) has developed an innovative concept in the field of waste-mining, which is unique in the world and offers a sustainable and economically-sound solution to the unresolved landfill issue and rising waste volumes.

In order to demonstrate this, MPI intends to launch one or more projects in 2008. For this purpose, various discussions with local and provincial councils will be held and preparations will be made.
In this respect, MPI works together with the Delft Technological University, Eindhoven Technological University, University of Twente, University of Wageningen, ECN and Saxion Polytechnic University Enschede.

MPI intends to be the first designated organisation that can offer a total solution to the landfill issue in the Netherlands within a period of two years.

Landfill risks according to NAVOS

The risks posed by landfills are described in detail in the reports on Former Landfill After-care Recommendations (NAVOS - *Advies Nazorg Voormalige Stortplaatsen*), April 2005, and Background Information on the NAVOS, April 2005.

Environmental and hygienic risks

The groundwater and surface water in about 30% of the landfill sites are highly contaminated, usually with heavy metals, and sometimes with organic micropollutants. This percentage may rise due to a possible disturbance of the chemical balance, and may lead to added strain on the environment in the future.

Measurements and literature search results show that waste materials always contain high concentrations of compounds, such as ammonium, nitrogen, sulphate and chloride. Likewise, high concentrations of heavy metals are almost always present, together with a variety of organic micropollutants.

Ninety percent of the former landfills are at risk because the thickness and the quality of the covering layer do not meet the applicable requirements. This may lead to direct human contact with hazardous waste material on the one hand, and contamination of surrounding properties and surface water on the other hand.

Former landfills release methane in the form of landfill gas. Even though less landfill gas is produced as landfills age, this uncontrolled risk counteracts the Kyoto protocol to limit greenhouse gas emissions.

Social risks

Former landfills are used for agriculture (30%), recreation (15%), wildlife areas (8%), business parks/residential development (10%) and other uses (34%). Considering the above environmental and hygienic risks, these figures do give cause for social concern.

Economic risks

Because of the negative image of former landfills, they are currently unmarketable for urban (re)development and unsuitable for agricultural use from the perspective of food safety. Thus, landfills have little economic value. New uses of landfills are therefore almost always out of the question.

MPI's sustainable (integrated) solution for landfills

Only partial solutions, such as transferring, removing and covering waste, have hitherto been provided to deal with the risks posed by landfills. MPI has risen to the challenge of providing a sustainable, economically-sound and integrated approach.

A small demountable plant using the latest recycling techniques[4] will be built on or near landfill sites. The use and combination of these technologies makes the plant innovative and unique in the world. How does it work in broad terms?

To sanitise landfills, MPI innovatively combines proven last-generation technologies in a closed system, creating an extra-efficient chain structure. This operates based on the principle of *close to zero* emission. The plant does not emit green greenhouse gases, thus eliminating the need for chimneys. This also reduces transport needs since the waste will be treated and processed on site.

The chain structure, called a Multi Purpose Unit (MPU), is made up of 22 installations and works according to the so-called building block principle. This means that the chain consists of the technologies that are needed to sanitise the composition of the specific landfill.
The principle of operation is that the output from technology or block 1 becomes the input for block 2, and then the output from block 2 becomes the input for block 3, and so on. This building block principle can also be used for small-scale operations. Thus, the concept creates optimal flexibility and controllability, which makes it possible to reach an above-average recycling quota per year.

Secondly, the MPI's business concept focuses on the treatment and reuse of individual flows of waste in the form of energy and raw materials. Depending on the waste flow, a partial MPU or chain structure will be set up.

After digging up the waste on the site, the production process sorts out and separates all recoverable raw materials. Afterwards, the waste flows are weighed, described and registered. Some products and raw materials (wood, metal, glass, building materials etc.) are recycled, cleaned and delivered to industries. A recycling quota of about 65-70% can be achieved in total.

During these processes, a large amount of energy can be produced out of the remaining 25-30% consisting of residual material (such as biomass). Likewise, large amounts of synthetic natural gas and diesel oil can also be produced and sold.

Toxic or harmful non-usable substances (about 0-5%) are destroyed on the spot.

Finally, the fully sanitised clean land can be used for new purposes, such as residential developments, business parks, recreation and agriculture.

Environmental benefits

During the business processes, approximately 70% of a landfill can be reclaimed in the form of raw materials and other reusable materials. Out of the remaining residual material (such as biomass) and through the recovery of heat, approximately 21 MW of energy can be produced, of which 6 MW is green electricity. About 40-45% of this energy will be used by the chain ("the plant") and the surplus can be delivered to the electricity grid, the gas mains and/or local buyers.
Synthetic natural gas and diesel oil are also produced during the processes.

[4] Techniques: sorting installation, shredders, presses, crushers, granulation, washing installation and the like, fermentor; distillers, fluidised bed gasification, pyrolysis installation (various types), water purification; Syngas/Biogas motor/Electrical installation; steam boiler; All individual technologies have been tested by the following accredited institutions: TU Delft, TU Eindhoven, TU Twente and ECN. The Biomass Technology Group, Enschede, among other companies, have conducted small-scale tests on the innovative operation of the combined technologies.

Toxic and harmful substances (about 0-5%) are destroyed on the site or permanently immobilised.

Economic benefits

An MPU with a standard treatment capacity of 500,000 tons/year will need an investment of approximately 46 million euros. Based on assessments which assume that the energy and raw material yield are lower than the current yield, an estimated profit of 19 million euros per year is considered feasible. The investment can thus be recouped in about 6 years. These calculations are based on an average landfill composition, as described in the NAVOS report published in 2005.
Neither the potential added value of sanitised former landfills for space planning nor the possibility of receiving subsidies is included in these business-economic calculations.

Since the MPI concept is based on the principle of *close to zero* emission, the use of any available emission rights of clients can be minimised.

Employment

During the implementation of a landfill sanitation project, about 70 jobs will be created, together with 5 undergraduate and 3 graduate internship positions.

Probability of success and the competitive edge of MPI's approach

MPI's approach has a good chance of succeeding for the following reasons:

- The integrated landfill after-care in line with the MPI's approach is preferred by relevant policy-makers.
- There is an urgent need for a sustainable approach to landfills.
- Government and society call for an increased production of green electricity and increased use of reusable raw materials in the production process.
- Waste treatment installations (*AVI - afvalverwerkingsinstallaties*) do not have sufficient capacity to incinerate the rising waste volumes, while incombustible waste materials continue to be dumped on landfills.

The competitive edge of the MPI concept over the current approaches to landfill management can be summarised as follows:

1. The waste materials and the land (ready for building) have value, and not the transport and the treatment in themselves.
2. MPI creates a demountable treatment chain which can be built on or right next to a landfill. This implies a considerable reduction in the logistical burden and operational costs.
3. Through the adoption and innovative combination of ultra-modern, small-scale and thus flexible technologies, MPI can guarantee a higher degree of efficiency than what can be achieved by current sanitation methods.
4. Efficiency can further be improved by means of a selected input, i.e. the output of combinations of separation technologies used as a conditioned input for various treatment technologies.
5. MPI can achieve a recycling quota of about 70% for usable materials. This is much higher than in current methods for dealing with landfills.
6. Non-usable substances (such as biomass), the remaining 25-30%, will be converted into energy.
7. Toxic and harmful substances (0-5%) are destroyed on site or permanently immobilised.
8. MPI provides a *close to zero emission* production process, which may create opportunities for emissions trading.
9. MPI carries out full and integrated landfill sanitation. The only material that will be brought back is sanitised soil.
10. By fully sanitising a former landfill, MPI creates enormous added value for space planning.

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Appendix IV

Frequently asked questions

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Appendix V

General conditions of Multi Purpose Industries

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