

ENVIS

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ENVIS NSWAI

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FROM THE EDITOR'S DESK

Economics of Solid Waste Management

- Cost Benefit Analysis

There has been a significant increase in Municipal Solid Waste (MSW) generation in the last few decades. Due to rapid urbanization and uncontrolled growth rate of population municipal solid waste management has become acute in India. The environmental problem arising from unscientific and indiscriminate disposal of municipal garbage is a real menace for the whole society. As per the 2001 data in India per capita waste generation had increased by 1.3% annually with urban population increasing between 3 – 3.5% per annum. Yearly increase in waste generation is around 5%. In India the municipal agencies spend 5-25% of their budget on SWM. Unfortunately, high capital investment in the solid waste management sector does not necessarily lead to improvements in the quality of service. Untreated/raw open dumping of municipal solid waste is common picture in India which may cost several environmental and public health problems. Landfills are also becoming increasingly expensive because of the rising costs of construction and operation. Incineration, which can greatly reduce the amount of incoming municipal solid waste produce ash which contain hazardous materials including heavy metals and organic compounds such as dioxins. Recycling and Recovery (treatment/processing) plays a large role in solid waste management. The purpose of this Newsletter is to describe and analyze, through an economic lens, the generation and Management of Municipal solid waste.

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Economics of Solid Waste Management

The purpose of this Newsletter is to describe and analyze, through an economic lens, the generation and Management of Municipal solid waste. MSW represent an undesirable by-product of certain economic activities. It is generally not devoid of resource value. Some of this value is captured through private economic activity, for example, informal sector scavenging and recycling practiced throughout the developing world and through community-sponsored recycling system and conversion of MSW into energy or compost or both.

Economics of Solid Waste Management has become a crucial topic of discussion due to a number of reasons.

- a. Solid waste is a significant and growing problem in many urban areas of both developed and developing world.
- b. The available spaces for land filling are getting scarce and land prices are increasing.
- c. Uncontrolled landfill disposal of solid waste is a pervasive problem which causes a range of external costs, including human health hazards.
- d. Recycled materials are gaining popularity on the belief that they could save earth's dwindling natural resources.
- e. Current systems of waste management in most developing countries are very rudimentary at best and are grossly inefficient and ineffective.

The functions and services of the environment have either no prices or have non-optimal prices which in turns lead to overuse or overexploitation of these functions and misallocation of resources. Therefore environmental problems such as solid waste are basically problems of non-optimal pricing and misallocation/misuse of resources. Thus, we can see environmental problems such as Solid Waste as problems of human welfare.

Environmental Cost Benefit Analysis (CBA), refers to the economic appraisal of projects that have the deliberate aim of improving the provision of environmental services or actions that might affect (sometimes adversely) the environment as an indirect consequence.

Cost of Municipal solid Waste Management

The municipal agencies spend 5-25% of their budget on SWM, which is Rs. 75-250 per capita per year (Kumar and Gaikwad, 2004). Normally a city of 1 million populations spends around Rs. 10 crores for this activity. Urban Local Bodies spend around Rs.500/- to Rs.1500/- per metric ton on solid waste management of which 60-70% of the amount is spent on collection alone, 20 - 30% on transportation. Inadequate fund is available for treatment and disposal of waste and is negligible part of solid waste management so far. Unfortunately, high capital investment in the solid waste management sector in many developing countries does not necessarily lead to improvements in the quality of service. Hence untreated/raw open dumping of municipal solid waste is common picture in India which may cost several environmental and public health problem.

Environmental Cost

Improper solid waste management causes all types of pollution air, soil and water. Indiscriminate dumping of wastes contaminates surface and ground water supplies. In urban areas, solid waste clogs drains, creating stagnant water for insect breeding and floods during rainy seasons. Uncontrolled burning of wastes and improper incineration contributes significantly to urban air pollution. Greenhouse gases are generated from the decomposition of organic wastes in landfills, and untreated leachate pollutes surrounding soil and water bodies. These negative environmental impacts are only a result of solid waste disposal; they do not include the substantial environmental degradation resulting from the extraction and processing of materials at the beginning of the product life cycle. In fact, as much as 95 percent of an item's environmental impact occurs before it is discarded as MSW. Health and safety issues also arise from improper solid waste management. Human fecal matter is commonly found in municipal waste. Insect and rodent vectors are attracted to the waste and can spread diseases such as cholera and dengue fever. Using water polluted by solid waste for bathing, food irrigation and drinking water can also expose individuals to



disease organisms and other contaminants. Waste workers and pickers are seldom protected from direct contact and injury; and the co-disposal of hazardous and medical wastes with municipal wastes poses serious health threat. Exhaust fumes from waste collection vehicles, dust stemming from disposal practices and open burning of waste also contribute to overall health problems.

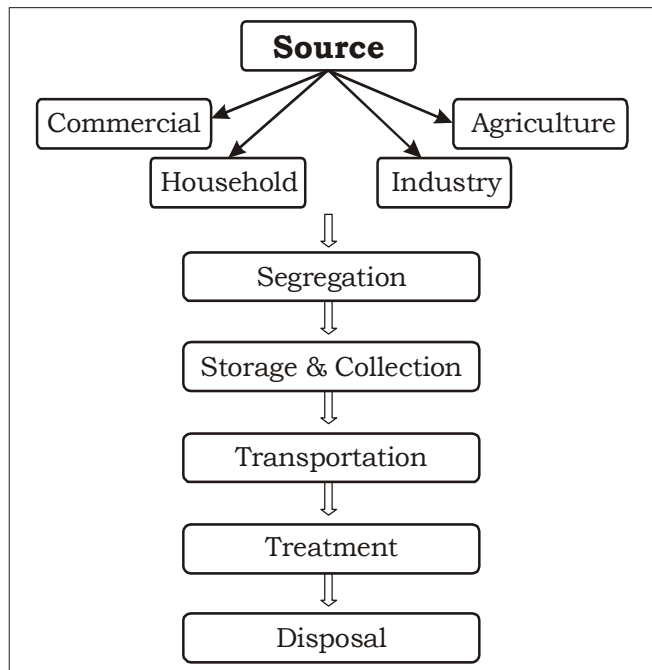
Importance of a sound solid waste management program

Solid waste management involves interplay of six functional elements, namely generation of waste, storage, collection, transfer and transport, processing and recovery and disposal. It encompasses planning, organization, administration, financial, legal and technological aspects involving interdisciplinary relationships. Solid waste management includes all activities that seek to minimize the health, environmental and aesthetic impacts of solid wastes. In an attempt to accelerate the pace of its industrial development, an economically developing nation like India has failed to pay adequate attention to solid waste management. Such a failure incurs a severe penalty at a later time in the form of resources needlessly lost and a staggering adverse impact on the environment and on public health and safety. The penalty is neither avoided nor lessened by a resolve to do something about the waste at a later time. Hence for Sound Solid waste management steps have to be taken throughout the life cycle of the Waste.

Life Cycle assessment of Municipal Solid waste

The life cycle of waste is often referred to as a journey from when an item is put on the curb or placed in a dumpster to when value is restored by creating usable material or energy, or the waste is transformed into emissions to water or air or into inert material placed in a landfill.

Waste minimization can be achieved in an efficient way by focusing primarily on the 4Rs, “reduce,” followed by “reuse” and then “recycle” and finally “recover”. The concept of minimizing waste impacts in terms of quantity or ill-effects, by reducing quantity of wastes, reusing the waste products with simple treatments and recycling the wastes by using it as resources to produce same or modified products and recovery of energy/useful product is usually referred to as 4R.



Benefits of 4R in the life Cycle of Solid Waste Management

Ecological sustainability in several ways:

1. Demand for natural resources is reduced.
2. Emissions to environment are decreased (less energy is used for reprocessing secondary materials than for extraction of virgin materials).

3. The amount of the solid waste is reduced and smaller amounts of waste remain for disposal.
4. Decrease the burden on collection services as well as on treatment and final disposal facilities.
5. Introduction of Cleaner production.

Disposal of Solid Waste

Sanitary Landfills have also been widely unsuccessful in countries like India because the landfill sites have a very limited time frame of usage. The population of the developing countries is another factor that detrimentally impacts the function of landfill sites. As the population keeps increasing, the garbage quantity also increases, which, in turn, exhausts the landfill sites. Landfills are also becoming increasingly expensive because of the rising costs of construction and operation. Incineration, which can greatly reduce the amount of incoming municipal solid waste. However, incinerator ash may contain hazardous materials including heavy metals and organic compounds such as dioxins. Recycling and Recovery (treatment/processing) plays a large role in solid waste management.

Recycling

Recycling can be the first choice in solid waste Disposal. Recycling is the recovery and reuse of materials from wastes. Solid waste recycling refers to the reuse of manufactured goods from which resources such as steel, copper, or plastics can be recovered and reused. Recycling can also play a keyrole in the GHG reductions that occur when recycled materials are used instead of virgin materials, saving energy. Reuse of recovered material generally requires less energy than the use of virgin material. For example for every ton of recycled paperboard packaging produced, there is an overall net reduction of 3.6 metric tons of carbon dioxide emission. In addition the amount of energy that is wasted by not recycling paper, printed material, glass, plastic and aluminum and steel cans is equivalent to the output of 15 medium sized power plants. Recycling also diverts waste from landfills and offsets landfill methane emission in that manner.

Pearce and Brisson(1993) show that various economic instruments can be used to balance the marginal costs and benefits of recycling to arrive at an optimum level of recycling.

The optimum condition of recycling is given as:

$$PR + CD + CDE = CSC + CR + CRE$$

PR = price of recycled material

CD = marginal cost of disposal

CDE = marginal environmental cost of disposal

CSC = marginal cost of separate collection

CR = marginal financial cost of recycling

CRE = marginal environmental cost of recycling

The left-hand side of the above equation is the benefit of recycling .

The right hand side is the cost of recycling. Hence we get:

$$\text{Marginal Benefit} = \text{Marginal Cost of Recycling}$$

Dutch Successes of recycling

Netherlands is able to recycle more than 64% of its waste – and most of the remainder is incinerated to generate electricity. As a result, only a small percentage ends up in landfill. In the realm of recycling this is a country which is practically unique. The Dutch approach is simple: avoid creating waste as much as possible, recover the valuable raw materials from it, generate energy by incinerating residual waste, and only then dump what is left over – but do so in an environmentally friendly way. This approach – known as ‘Lansink’s Ladder’ after the Member of the Dutch Parliament who proposed it – was incorporated into Dutch legislation in 1994 and forms the basis of the ‘waste hierarchy’ in the European Waste Framework Directive. The DWMA promotes the interests of some 50 companies that are involved in collecting, recycling, processing, composting, incinerating and land filling waste.

The Netherlands has a unique ‘waste management structure’. Dutch companies possess the expertise to get the maximum from their waste in a smart and sustainable manner. This forward-thinking process of waste management started in the 1980s when awareness of the need for alternatives to landfill

began to grow earlier than in other countries. There was a lack of potential disposal sites and a growing environmental awareness among the public at large. Introducing a tax on every tonne of material landfilled was key as it gave waste processing companies the incentive to look for other methods – such as incinerating and recycling – simply because they were now much more attractive from a financial point of view.

Recycling of the Construction and demolition waste

Common C&D materials include lumber, drywall, metals, masonry (brick, concrete, etc.), carpet, plastic, pipe, rocks, dirt, paper, cardboard, or green waste related to land development. Of these many materials can be reused or recycled, thus prolonging our supply of natural resources and potentially saving money in the process. At present there are several companies in Europe and United Nations working in this area. In India certain companies has started recycling of construction

and demolition waste whereas there is need to explore more in this sector.

Recovery

There is great potential of recovery from municipal solid waste. Following are some of the method by which material/energy /material (compost) is obtained.

1. Material Recycling.
2. Waste to energy and Conversion technologies: Facilities where waste becomes energy.
 - Landfill gas – trapping and utilization of the gas or conversion to electrical power.
 - Anaerobic digestion - utilization of the gas or conversion to electrical power.
 - RDF (refuse derived fuel).
 - Incineration (mass burn).
3. Composting: Where organics in solid waste undergo controlled decomposition.

Broad Cost benefit of processing method is given in the following table:

Criteria	Cost Benefit Analysis		
	Wastes minimization through 3R-implementation	Composting	Waste -to-Energy Technology
Environmental	<ul style="list-style-type: none"> • highly positive contribution • avoids materials to come to the environment • conserve resources • conserve energy • reduce odor and emissions, no leachate production • reduce global warming effect • adds up aesthetic beauty • less risky to human health • increase entire life span of landfill sites 	<ul style="list-style-type: none"> • Highly positive impact to environment • No organic carbon left after this treatment • No leachate production • No organic or CH₄ gas production or reduction of CH₄ gas by 80% • No smell and flies • Less risk to human health • Leachate can be reused back for the sprinkler for windrows, less risk of contamination to the nearby agricultural land 	<ul style="list-style-type: none"> • Reactive approach and perfectly an end-of-pipe treatment • Potential for leachate production andcontamination to the nearby agricultural land and water bodies • Potential for odor and smell production thatcreate problems to the nearby communities and natural environment • High risk to human and environmental health • High potential for energy production from CH₄ • Reduces the CH₄ emission and replaces the fuels by the clean energy i.e. electricity

Criteria	Cost Benefit Analysis		
	Wastes minimization through 3R-implementation	Composting	Waste -to-Energy Technology
Technical	<ul style="list-style-type: none"> • Low cost or no sophisticated technology required • Use of easily available equipments & machines • Less land area requirement • Major activities involve manual operation • No highly skilled technical expertise required 	<ul style="list-style-type: none"> • Medium cost technology • Most of the equipments and parts are available at local market • Use of locally available resources/ materials • Requires large land area (for 100 tons of wastes, requires about 3 hectares of land area to operate), Suitable for sub-urban area • Not convenient for high amount of wastes generation • Technology transfer, requires technical expertise • Need sufficient supply of oxygen 	<ul style="list-style-type: none"> • High cost and highly sophisticated technology • Most of the equipments and part are not available in local market, mostly imported from US and Europe • Requires highly skilled technical expertise for both operation and maintenance. • Maintenance of some parts need the technical person from the company that supply the machine or engine
Economic (Socio - Economic)	<ul style="list-style-type: none"> • Income generating • Job creation (need more human resources i.e. opportunity of job for more people) • Improve living standard and provide good health • Least investment cost and fast payback period • Direct cash generation • Reduction in wastes management cost to a greater extent • Provide vocational training and training materials such as to school children • Good approach for awareness generation to people • Less or no public opposition and conflict • Requires more public participation 	<ul style="list-style-type: none"> • Not very high investment cost • Job creation • Achievement of both waste reduction and waste recycling • High reduction of wastes volume to be land filled Reduction in wastes management cost (by nearly 50%) • Increase of life span of landfill site to a greater extent (nearly three times compared to conventional MSW management) • Less public opposition and conflict • A community based approach and an effective tool for public communication and involvement 	<ul style="list-style-type: none"> • High investment cost • High operation and maintenance cost • Less job creation to people • High revenue generation from electricity sale • Significant neighborhood opposition for the land disposal of wastes and associated problems. • Not cost-effective for small scale landfill sites. • High energy generation capacity can reduce the flow of fuel import to a greater extent

Municipal Solid Waste Technologies and Carbon Finance

Carbon finance provides an opportunity for an extra source of revenue for Solid waste Management. Carbon finance can be used with any technology that leads to the reduction or avoidance of carbon emission. Solid waste is significant source of pollution in particular emission of methane gas by anaerobic degradation. Carbon finance represents a good opportunity for solid waste projects in developing countries like India and gives incentives to operators to focus on good design and environment awareness to obtain this source of revenue.



Clean Development Mechanism (CDM)

Clean Development Mechanism (CDM), a project based mechanism has become a thought provoking option in the recent decade in mitigating GHGs emissions. It is a mechanism for promoting technology transfer and investment from developed countries to the developing countries for projects to reduce the emissions of GHGs (UNESCAP, 2003). Municipal solid waste is a significant source of methane emission which is 25 times more potent as a GHG than carbon dioxide. The potential CDM mechanisms that are being applied or can be applied in the MSW management sector in developing countries could be wastes-to energy such as capturing landfill gas and generate electricity, anaerobic digestion of organic fraction of wastes and production of biofuel or biogas, composting, as well as minimization of waste volume that would be sent to landfill. Therefore CDM is an excellent market-based mechanism which could help increasing efficiency of environmental management in GHG reduction and sustainable development. In this newsletter we have described some of the CDM project and their Economics. Some of the recovery methods and the case studies are given below.

Refuse Derived Fuel

Municipal solid waste energy plants can use either mass burn technology or refuse derived fuel technology. Mass burn is the method that is used most frequently, and in this process all of the MSW is combusted. In refuse derived fuel plants the waste is sorted before being combusted, so that certain recyclables like metals are removed before the waste is burned. This takes advantage of municipal solid waste recycling, so that fewer resources are used to replace these materials.

Benefit of RDF

Reduction of methane emissions from the landfills and also in generation of clean power.

Helps in reduction in GHG emissions due to the power generation using fossil fuels.



Case study

Project proponent:	Municipal corporation Vijayawada and Gunter, Andhra Pradesh
Title of project:	RDF based power project generating 6MW electricity
MSW generated:	450 TPD
Caloric value of RDF:	3000 Kcal/Kg
CER's generated/year:	42,487
Current CER price:	9 Euros
CDM revenue generated:	(42,487*9*60) = 2.3 Crore in first year

Composting of Municipal Solid Waste

Composting is a controlled biological process that uses natural aerobic processes to increase the rate of biological decomposition of organic materials. It is carried out by successive microbial populations that break down organic materials into carbon dioxide, water, minerals, and stabilized organic matter. Carbon dioxide and water are released into the atmosphere, while minerals and organic matter are converted into a potentially reusable soil-like material called compost. The loss of water and carbon dioxide typically reduces the volume of remaining material by 25% to 60%. Compost can be used as a soil amendment in a variety of agricultural, horticultural or landscaping applications.



Benefits of Composting

- Increases overall waste diversion from final disposal, especially since as much as 80% of the waste stream in low and middle-income countries is compostable
- Enhances recycling and incineration operations by removing organic matter from the waste stream.
- Produces a valuable soil amendment-integral to sustainable agriculture.
- Promotes environmentally sound practices, such as the reduction of methane generation at landfills.
- Enhances the effectiveness of fertilizer application.
- Can reduce waste transportation requirements.
- Flexible for implementation at different levels, from household efforts to large-scale centralized facilities.
- Can be started with very little capital and operating costs.

- The climate is optimum for composting.
- Addresses significant health effects resulting from organic waste.
- Provides an excellent opportunity to improve a city's overall waste collection program.
- Accommodates seasonal waste fluctuations, such as leaves and crop residue.
- Can integrate existing informal sectors involved in the collection, separation and recycling of wastes.

Case Study

1. Nashik Compost Project

In Nashik Municipal Corporation area around 230 MT of solid waste is generated per day. A compost factory has been established by the corporation for converting garbage into valuable compost / manure. The garbage is collected with the help of special vehicles named "Ghantagadi". Nashik Municipal Corporation has established a compost plant at the cost of Rs.4.61 crores from its own funds for the processing of waste. The plant is fully owned by the municipal corporation the waste collected is transported to the compost plant where it is mechanically segregated and processed to produce fine quality compost. The garbage collected from the city contains about 40% non-biodegradable material, which cannot be converted into compost is transported to the sanitary landfill site developed near the compost plant. The compost meets all the chemical parameters and is helpful to the farmers, especially the grape growers in and around Nashik. The plant is operated on aerobic microbial composting method. Nashik Corporation is operating the plant in one shift. Cost of **production of one MT of compost manure is Rs.1700.**

Benefits: The Corporation is able to treat about 230 MT of garbage per day The Grape growers are prime market for compost which is sold in the market at a reasonable price that is Rs 1700 per one MT from 2009 they have increased the rate up to Rs 2000 /Mt to the farmers around Nashik. So there is a net profit of Rs 300/Mt.

Source : As reported S.R Male Consultant to the project.

2. Compost and CDM:

Lahore Composting Project

Pakistan is the most urbanized country in South Asia, with 35% of the population living in urban areas. Solid waste is a major environmental and health hazard in Pakistan. Less than 50% of the waste generated is collected, and even then it is disposed of at dumps or roadsides. About 6,000 tons of municipal wastes are generated daily in Lahore; more than half is organic content that could be reduced substantially by large-scale composting. The project consists of establishing a composting plant at a landfill in the Mehmood Booti area of Lahore city, which will avoid methane emissions and significantly decrease the amount of waste by applying a simple aerobic-type composting technology. The **Danish Carbon Fund** will purchase emission reductions of over 300,000 tons of carbon dioxide equivalent over a six-year period. Further benefits will include reduction of waste-related health hazards, improvement of cultivated land by use of the compost and recycling of valuable materials.

Benefit of the Project

Sale of Carbon Credits

(@US\$11/tons of CO₂) 0.858 \$million

Sale of 5591 metric tons of compost/year

(@Rs.250 per 50 Kg bag) 0.940 \$million

Total Estimating annual Revenue
1.798 \$million

Landfills Gas Project

Most of the waste we generate ends up in landfills, where it decomposes and produces landfill gas. Landfill gas, if uncontrolled, can contribute to local smog and present health and safety hazards landfill gas mostly compromises of methane which 21 times more potential of global warming. Some of the benefits to highlight include:

Environmental Benefits. Landfill gas energy projects lead to cleaner air, including reductions in smog, odor, and greenhouse gas emissions.

Economic Benefits. Landfill gas energy projects create jobs associated with the design, construction and operation of energy recovery

systems. Much of the construction and development funding is spent locally for drilling, piping, construction, and operational personnel. Also, economic development near the landfill may improve as a result of odor reductions or other project activities.

Community Benefits. Using landfill gas is a win/win situation for all project partners, especially the community. Landfill gas energy projects help ensure that local landfills are well managed and make the area around the site a better place to live.

Energy Benefits. Landfill gas is a reliable, renewable, local fuel source that reduces our reliance on fossil fuels. Landfill gas is also the only renewable that directly reduces pollution to the atmosphere. Since landfill gas occurs naturally, by collecting and converting it to energy, you are putting to use a fuel source that would otherwise have been wasted. Landfill gas energy projects are available to generate electricity over 90 percent of the time, 24 hours a day and 7 days a week.

Cost of installation of power generation and on the profitability of generating energy from waste depend upon:

Quantity of waste. A landfill with 1 million tons of waste-in-place can typically support an 800 kilowatt (kW) to 1 MW electricity generation project.

Waste Placement History. Older waste produces less methane.

Waste Composition. Organics produce high quantities of methane.

Site Conditions: Status of Landfill Operation either it is a Open dumps or recently closed (less than 5-7 years).

Case study

The Gorai Solid Waste Disposal Site, Mumbai.

Name of the project: Scientific Closure of Gorai dumping ground and its subsequent maintenance.

Client : Municipal Corporation of greater Mumbai.

Consultant/Project developer: IL&FS Ecosmart Limited.

Contract Awarded to M/s. United Phosphorus Limited & Van Der Weli Storage BV (JV).

Total Contract Value Rs 503 millions.

Revenue from CDM Rs 720 millions (projected) / Rs 245 million (received).

It spreads over an area of 19.61 ha and is operational since 1972. Daily receipt was upto 2200 TPD of MSW from the western suburbs of Mumbai wards Project detail Since the MSW accumulate over the site had almost attained its highest capacity the scientific closure was recommended. The scientific closure was done by the Capping method. A landfill gas recovery system is installed at site to capture methane emission.



There are certain issues which requires more study

1. How safe is the capping method for landfill gas recovery system.
2. Life of methane generation: The solid waste in this kind of dump site is too old which produce methane for less period of time.

Case Study

Jordan: Aman Landfill Gas Project

*Collaboration between the Greater Amman Municipality (GAM) and the World Bank in municipal solid waste disposal constitutes an important step towards a greener society, through the implementation of the first commercial-scale project converting landfill gas to energy at the **Ghabawi Sanitary Landfill site**, located 40 kilometers east of the center of Amman, Jordan and is owned and operated by GAM. This is an innovative solid waste management project that will contribute not only to the improvement of solid waste management in greater Amman, but also offers*

Amman the opportunity to mobilize additional and unconventional revenues and to mitigate negative environmental effects at both the local and global level.



One of the main component objectives of this project is to avoid methane (a greenhouse gas) emissions from the Ghabawi Sanitary Landfill by installing landfill gas collection and electricity generation plant. This will introduce environmentally friendly technology, and generating electricity from LFG. The electricity is delivered to the grid and replaces electricity produced from power plant using heavy fuel oil, which means that in addition to the CH₄ emission reduction on the landfill there will also be a CO₂ emission reduction from the power plant. Under the agreement for GAM, the World Bank will purchase 900,000 tons of CO₂-equivalent of Certified Emissions Reductions (CER) up to the end of 2014. The credits will be purchased by the World Bank's Carbon Fund for Europe (CFE). The total estimated emission reduction from the project during the first crediting period (7 years) is estimated at 1,519,963 tons CO₂e for the period 2009 to 2015.

Economics Instrument for solid waste Management

To achieve right balance between Costs and benefits of recycling, recovery and disposal of Solid Waste, economic instruments options can be used are as follow:

- a. **Unit pricing for garbage collection** The most direct way to internalize the external cost of garbage disposal is to tax each bag of garbage. However in most developing and also developed countries households receive fixed price collection services, regardless of the amount they dispose of.

- b. **Virgin Material Taxes and Subsidies:** The problem associated with taxing or pricing garbage economists advocate the implementation of a tax on virgin materials (or reuse subsidy in the other way) to achieve an efficient allocation of resources in a scenario where garbage disposal produces external costs.
- c. **Advance disposal fee Deposit – Refund system:** Advance disposal fee (ADF) is a tax on goods levied at the time of sale, based on the cost of ultimate disposal of goods. The rationale behind such fee is that when goods are exchanged the externality from disposal of these goods is not reflected in the product price.
- d. **The Command and control policies** such as mandatory household recycling ordinances and minimum recycled-content standards on producers.

Remark

Management of Solid waste is a significant and growing problem in many urban areas of the Country. The collection and mainly disposal of waste pose external costs on society. The external cost takes varied forms like local pollution, transboundary pollution, global pollution, visual nuisances etc. Inadequate fund is available for treatment and disposal of waste and is negligible part of solid waste management so far. Such a failure incurs severe penalty at a later stage in the form of resources needlessly lost and a staggering adverse impact on the environment and on public health and safety. Thus, Sound Solid waste management is the need of the day, steps need to be taken throughout the life cycle of the Waste and adopt waste minimization strategy by following the principle of 4Rs that is Reduce, Reuse, Recycle and Recover. e.g., Netherlands is able to recycle more than 64% of its waste – and most of the remainder is incinerated to generate electricity. As a result, only a small percentage ends up in landfill. Recovery from municipal solid waste can be done through Material Recycling, Waste to energy and Conversion technologies like Landfill gas, Anaerobic digestion, RDF (refuse derived fuel), Incineration (mass burn) and Composting: Where organics in solid waste

undergo controlled decomposition. To achieve right balance between Costs and benefits of recycling, recovery and disposal economic instruments like tax or subsidy needs to be adopted. The economic instruments used in the waste management sector include Unit pricing for garbage collection, Virgin Material Taxes and Subsidies, Advance Disposal Fees and Deposit – Refund system, Command and control policies such as mandatory household recycling ordinances and minimum recycled-content standards on producers. Such economic instruments would help in achieving balance between the costs incurred and the benefits achieved in the field of waste management and thereby achieve efficient outcomes.

References

- **Solid Waste Management and Greenhouse Gases:** A Life-Cycle Assessment of Emissions and Sinks 3rd edition (EPA), Sep 2006.
- **What a Waste: Solid Waste Management in Asia Urban Development**, May 1999, Urban Development Sector Unit East Asia and Pacific Region, **World Bank**.
- **Occupational and Environmental Health Issues of Solid Waste Management** Special Emphasis on Middle- and Lower-Income Countries, **Sandra Cointreau, the World Bank Report**.
- **Economics and Solid Waste Management in the developing world** by David Pearce & R. Kerry Turner University College London and University of East Anglia.
- Composting of Organic content of Municipal solid waste in Lahore, Pakistan .May 20, 2008 **The World Bank carbon financial unit**.
- <http://jnnurm.nic.in/nurmudweb/bestpractices/volII>
- <http://worldbank.org/urban/>
- <http://cdmunfccc/.int>

– Dr. Amiya Kumar Sahu

We would appreciate your feedback on this newsletter and welcome you all to contribute articles, news or in any other form pertaining to the Waste Management issues, for publishing in our subsequent newsletters.

Major National and International Events (April 2009- March 2010)

1. ANSWAI CONFERENCE on Solid Waste & Environment

Save Our Blue Planet

1st International Conference and Exhibition Jointly organized by Anna University



Coimbatore and NSWAI on **12-14 August, 2009.**

The three days conference and exhibition was designed to provide delegates a platform in gaining knowledge by sharing experiences and interaction in order to meet today's challenges of achieving integrated and sustainable solid waste management specifically in India.

Key features of the conference :

- The exhibition was organized to display innovative equipments, systems, processes etc.
- Submission of papers from researchers, practitioners, students and NGOs.



2. Conference on Waste Management was organized by **Everything About Environment** in Association with **NSWAI** in August 2009, Mumbai.

The conference addressed waste

management practices, possibilities, innovation and “Reduce-Reuse-Recycle” solution with a view on modern waste management infrastructure, effective waste management strategies and waste minimization for making continued progress toward prevention of pollution.

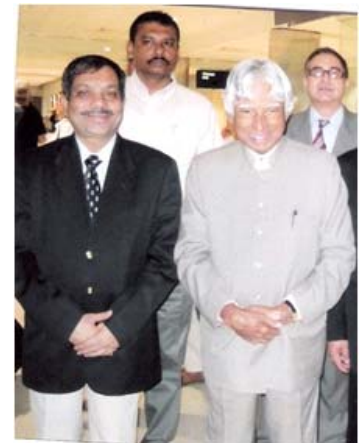
3. National Seminar on Wealth from Live Stock and Agricultural Waste 12-13 November 2009.



Inaugural address by Convener NSWAI- ENVIS.

4. Marcus-Evan Conference on Sustainable manufacturing - Greening your Process Jan 2009 Kula Lumpur Malaysia endorsed by NSWAI-ENVIS.

5. NSWAI president was invited as guest to HE ex- President of India A.P.J.Abdul Kalam at Oakland University, Ohio State USA.



6. Guest lecture at San Diego State University of Engineer, California, October 2009.

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