Resources up in Flames

The Economic Pitfalls of Incineration versus a Zero Waste Approach in the Global South

Brenda Platt, *Institute for Local Self-Reliance*

for **Global Alliance for Incinerator Alternatives/ Global Anti-Incinerator Alliance**

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by
Brenda Platt
Institute for Local Self-Reliance

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GAIA
Global Alliance for Incinerator Alternatives
Global Anti-Incinerator Alliance

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Tel/Fax: (632) 9399151 email: ycpub@pinoymail.com

About GAIA

Global Anti-Incinerator Alliance / Global Alliance for Incinerator Alternatives

GAIA brings together a broad spectrum of community-based organizations, research and policy advocacy institutions, citizen pressure groups and other nonprofit organizations and individuals working to end the burning of all types of discards and to promote clean production, zero waste, and sustainable discard management systems. GAIA members are committed to both ending waste incineration and advancing real solutions to discard management problems, hence its twin names: Global Anti-Incinerator Alliance and Global Alliance for Incinerator Alternatives.

GAIA Mission:

We are a global alliance of nonprofit organizations and individuals who recognize that our planet's finite resources, fragile biosphere and the health of people and other living beings are endangered by polluting and inefficient production practices and health-threatening disposal methods.

We oppose incinerators, landfills, and other end-of-pipe interventions. Our ultimate vision is a just, toxic-free world without incineration. Our goal is the implementation of clean production, and the creation of a closed-loop, materials-efficient economy where all products are reused, repaired, or recycled back into the marketplace or nature.

For more information contact:

GAIA
Unit 320, Eagle Court Condominium,
26 Matalino Street, Barangay Central,
Quezon City 1101, Philippines
Tel: 63 (2) 929 0376 • Fax: 63 (2) 436 4733
Web: http://www.no-burn.org
Email: info@no-burn.org

GAIA
1442A Walnut Street, #20
Berkeley, California 94709, USA
Tel: 1 (510) 883 9490 • Fax: 1 (510) 883 9493
Email: info@no-burn.org

About ILSR

Institute for Local Self-Reliance

The Institute for Local Self-Reliance (ILSR) is a nonprofit research and educational organization that provides technical assistance and information to city and state governments, citizen organizations, and industry. Since 1974, ILSR has researched the technical feasibility and commercial viability of environmentally sound, state-of-the-art technologies with a view to strengthening local economies. ILSR works with citizens, government, and private enterprise in the development of a comprehensive materials policy oriented towards local ownership, efficiency, recycling, and maximum utilization of renewable energy resources.

For more information contact:

Institute for Local Self-Reliance
927 15th Street, NW, 4th Floor
Washington, DC 20005, USA
Tel: 1 (202) 898 1610 • Fax: 1 (202) 898 1612
Web: http://www.ilsr.org
Email: wastetowealth@ilsr.org

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Monica Wilson, Essential Action, Berkeley, CA, USA

All responsibility for the views expressed in this report or for any errors in it rests with the author.

Foreword

In the words of GAIA member Dr. Paul Connett: "It's not waste until it's wasted." ***Resources up in Flames: The Economic Pitfalls of Incineration versus a Zero Waste Approach in the Global South***, describes a variety of programs that recover, reuse, recycle or compost discarded material, thus preventing or delaying its being wasted.

The idea for documenting the economic benefits of programs that recover materials from the discard stream arose from discussions at GAIA's founding meeting in South Africa in December 2000. There, GAIA members from around the world shared examples of successful community-based discard management projects which not only lessened environmental impacts, but also created jobs and contributed to the local economy. We hoped that documenting these programs would inspire other community and government leaders to opt for safer and more sensible approaches over incineration.

Resources up in Flames focuses on recycling and composting portions of the municipal discard stream. These are critically important elements of any discard management strategy, especially in areas with a high percentage of organic wastes. However, while GAIA recognizes the importance of recycling, we also recognize its limitations. With the current volume, variety and toxicity of today's discard stream, recycling and composting are critical, but they aren't enough.

As long as our industries continue to use persistent toxic materials in their processes and products, recycling and other waste diversion programs will face materials that simply cannot be safely reclaimed. For recycling to succeed, diversion programs like those described in *Resources up in Flames* must be established simultaneously with programs for reducing the overall volume and toxicity of material used, long before it becomes waste. This dual approach prevents pollution, conserves natural resources, and invests in local economic development.

It is this combination of tackling the problem upstream (through improvements in production processes and materials used) and downstream (through reducing consumption and recovering discarded materials), that comprises GAIA's vision of zero waste. While we recognize that communities cannot eliminate waste overnight, zero waste provides a vision, a direction and a goal to guide materials management decisions. A commitment to zero waste frees communities from the incineration trap and gets them on the road to real solutions. GAIA looks forward to working together with communities across the globe towards this goal.

GAIA's International Co-coordinators

Von Hernandez — *Philippines*

Ann Leonard — *U.S.*

Executive Summary

The amount of unwanted discards thrown away in industrializing nations[1] has reached crisis proportions in recent years. Rising population,[2] rural to urban migration, increased globalization of Western consumer patterns and the proliferation of single-use disposable products and packaging are partly to blame. Landfills, typically nothing more than open dumps, are filling up and people are sprawling beyond city borders, limiting the ability to develop new landfills. In an effort to find new solutions to growing disposal headaches, many nations are shifting to the formal private sector, embracing technology-driven approaches, and turning to the old technique of waste incineration. However, incinerators—no matter where they are built—have numerous liabilities. Waste incinerators:

- generate pollution,
- harm public health,
- place huge financial burdens on host communities,
- drain local communities of financial resources,
- waste energy and materials,
- thwart local economic development,
- undermine waste prevention and rational approaches to discard management,
- have an operating experience in industrialized countries checkered with problems,
- often exceed air pollution standards,
- create toxic ash,
- can go financially bankrupt from tonnage shortfalls, and
- often leave citizens and taxpayers paying the bill.

Incineration technology, designed and tested for the discard streams and infrastructure in industrialized nations, can be expected to perform even more poorly in industrializing countries due to differences in discard stream characteristics, inadequate regulatory structures and institutional arrangements, lack of convertible currency for purchase of spare parts, lack of skilled workers, and economic systems that favor labor over capital.

Incinerator proposals—along with proposals to centralize and privatize waste management systems—are often presented as the only solution to handle growing amounts of discards. Fortunately other options exist. Indeed, non-incineration alternatives can be comprehensive, handle discarded materials from large urban areas, and be carried out in industrializing countries with minimal resources. Furthermore, alternatives cost a fraction of the cost of incineration, employ many more workers than incineration, and pollute far less. In industrializing countries, source-separation recycling and composting programs (in which recyclable and organic materials are segregated at the household level) have the potential to divert 90% of household waste from disposal, a level incineration cannot achieve.

Chennai (formerly Madras), India, makes a good case to illustrate the benefits of a recycling/composting approach compared to reliance on incineration. A US$41 million incinerator has been proposed for the city (population 4.3 million) that would gasify 600 tonnes per day of municipal discards. Local authorities are moving toward privatizing waste collection and, as a result, have already jeopardized community-based recycling and composting initiatives. In fact, Chennai is home to Exnora International, a nonprofit organization spearheading a decentralized recycling/composting approach that has inspired similar projects across India.

In Chennai the infrastructure exists to collect only 2,500 of the 3,500 tonnes of discards generated each day. Almost 30% is left uncollected littering streets and neighborhoods. This is typical of less-industrialized nations. Thus incinerators in Chennai, at most, could hope to receive 2,500 tonnes per day. But not all material discarded is incinerable; about 5 to 10% is considered "by-pass" materials that might, for instance, include large nonburnable items such as engine blocks, or represent waste landfilled when the incinerator is not working. In addition, on average 25% by weight of what is burned ends up as ash that still requires landfill disposal. In our Chennai example, incineration would only divert 1,750 metric tonnes a day or half of the total waste generated. In contrast, Exnora's decentralized community-based waste reduction approach involving segregated collection of recyclables and organics for composting has the potential to divert 90% of all the 3,500 tonnes generated each day. The heart of Exnora's program is teaching citizens to take responsibility for their discards and not to litter. (See pages 47-51 for more information on this approach.) This approach can go even further when combined with programs to reduce the overall volume and toxicity of materials used. In terms of costs, the recycling/composting approach is far more cost-effective (US$4.6 million compared to US$119 million). Furthermore, the incineration

Definition of waste incineration

For the purpose of this report, waste incineration refers not just to the mass burn (with or without energy recovery) and refuse-derived-fuel systems well established in industrialized countries, but to any type of thermal treatment system for discarded materials that wastes resources and emits pollutants. These include technologies based upon combustion, pyrolysis, and thermal gasification. Like combustion, pyrolysis and gasification systems produce dioxins, furans, and other persistent pollutants.

Combustion is simply put, burning or oxidation of compounds. Combustion of hydrocarbons produces heat, light, water, and carbon dioxide. Ash is a combination of materials incompletely combusted and new solids formed during oxidation. The two most common combustion technologies for solid waste are:

- **Mass burn**, in which waste is directly burned. Often the heat produced during the burning is used to convert water to steam to drive a turbine connected to an electricity generator.
- **Refuse-derived fuel (RDF)**, in which mixed waste is processed prior to direct combustion. The level of processing varies among facilities, but usually involves shredding and removal of metals and other materials with low Btu content. The processed materials are then used as fuel either in the same manner as at mass burn plants or to fuel existing facilities such as cement kilns.

Pyrolysis is the thermal degradation of materials by heat in the absence of or with a limited supply of oxygen. In a pyrolysis unit, materials are heated to a temperature between 800 and 1400 degrees Fahrenheit (427 to 760 degrees Celsius). The lack of oxygen aims to prevent combustion. However, eliminating all oxygen is virtually impossible; some oxidation occurs and results in the formation of dioxins and other related hazardous compounds. Pyrolysis results in three products - gas, fuel oil, and a solid residue called "char" (likely to contain heavy metals).

Thermal gasification is similar to pyrolysis except that the thermal transformation of solid waste takes place in the presence of a limited amount of air or oxygen, producing a combustible gas. This gas can then be used in either boilers or combustion turbine/generators. This process generates solid and liquid byproducts, which may contain high levels of toxic contaminants.

A note on tonnage units: In this report, "tonne" refers to a metric ton (1,000 kg). All tonnage is given in metric tonnes.

A note on terminology: This report often uses the term "discards" for what many call "waste." Discards are used resources that are reused, recycled, composted, or wasted. Waste is discarded material removed from commerce (or the environment) and whose residual value is destroyed by burning, burying, or other means.

Table 1: Comparison of incineration versus a recycling/composting approach in Chennai, India

	Incineration	Recycling/Composting Approach
Metric tonnes per day generated	3,500	3,500
Metric tonnes per day diverted from landfill disposal	1,750	3,150
Diversion level	50%	90%
Capital cost (US$)	$119 million	$4.6 million
Workers employed	320	5,600
Impact	waste encouraged dirty environment with much litter citizens oppose system increased truck traffic and pollution citizens continue throw-away habit reliance on foreign technology and know-how	waste reduced clean environment and neighborhoods citizens support and are involved in system decreased truck traffic (reliance on pedal power) citizens take responsibility for waste reliance on local resources and know-how

Note: Incineration costs are based on a 600 tonne-per-day incinerator planned for Perungudi in Chennai (plant cost is Rs 200 crore or US$41 million). (One crore is 10 million Rs.) Three incinerators would be needed to handle the 1,750 tonnes per day. Jobs for the incinerator are based on employment figures for U.S. incinerators. The costs and employment for the recycling/composting approach are extrapolated from Exnora International's recycling/composting program model, which is working in many communities across India. Tonnage data for Chennai was reported in The Hindu, June 18th, 2002, and attributed to Exnora International.

Source: Institute for Local Self-Reliance, Washington, D.C., U.S., April 2004.

system has a far more detrimental impact on the environment, local economic development, and other quality-of-life aspects such as truck traffic. See Table 1.

While the figures above are theoretical, they are based on actual data of operating projects. Indeed, numerous projects around the world have demonstrated that integrated programs for waste prevention, reuse, recycling, and composting can significantly reduce disposal at a lower cost than incineration.

To be effective, discard management systems must be based on appropriate technical solutions and be designed with local conditions and needs in mind. Most industrializing countries have limited experience with operating and maintaining centralized discard handling systems. Thus, the less complicated the technology, the more successful it will be. Most industrializing countries have a significant informal sector already engaged in extensive recycling activities. A system designed in partnership with this sector and with other community efforts and micro-enterprises will also have a better chance of success. In fact, integrating the informal sector and community initiatives into citywide discard management planning is not only possible but may be the key to success. The informal sector and community programs may need only an institutional structure and land for activities such as composting to be scaleable to city levels. Indeed, community projects can become mainstream solutions. They need not be forever relegated to local small efforts.

Some successful innovative approaches to managing discards and reducing waste in the global South include the following.

- **Cairo, Egypt**: informal sector workers—known as zabbaleen—collect one-third of Cairo's household discards, about 998,400 tonnes per year. The zabbaleen, who live in five neighborhoods surrounding Cairo, recycle and compost 80 to 90% of what they collect. One neighborhood, Mokattam, is

home to approximately 700 garbage collecting enterprises, 80 intermediary traders, and 228 small-scale recycling industries.

- **Mumbai, India (formerly known as Bombay)**: citizens have set up neighborhood associations – each known as an Advanced Locality Management (ALM) – in which members keep their environment clean and separate their discards into biodegradable and non-biodegradable types for composting and recycling. Many ALMs vermicompost (worm compost) wet organic materials and work with ragpickers to recycle other discards. About 650 ALMs exist, representing about 300,000 citizens.

- **Barangay Sun Valley, the Philippines**: approximately 3,000 households participate in a recycling and composting program that diverts 70% of their household discards from disposal. "Biomen" collect segregated organic material (kitchen scrap and garden trimmings) for composting on a daily basis using pedicabs. The same pedicabs collect segregated recyclables from households. They deliver recyclables to the nearest "eco-shed" for further sorting and baling. Processed material is sold directly to scrap or "junk shop" dealers.

- **Rio de Janeiro, Brazil**: in 2000, this state passed a mandatory packaging take-back law, which requires the take-back of all plastic packaging and its subsequent reuse or recycling.

A growing zero waste movement is gaining momentum worldwide and innovative regulatory systems requiring "extended producer responsibility" for products promise to reduce disposal even further. Local, national, regional, and international networks of concerned citizens and professionals have formed to halt proposals for new incinerators, phase out old ones, and push for alternative systems based on sustainable production and consumption patterns.

Zero waste is a worthwhile goal, but it will take some time to achieve it. Just as a journey of a thousand miles begins with a single step, so too does aiming for zero waste. The road to zero waste can begin with the simple and relatively inexpensive act of keeping organic and putrescible material out of landfills and dumps. This alone won't provide a total solution, but will go a long way toward solving problems related to dirty, leaking, and overflowing dumpsites. This is especially true in the global South where organic material makes up the largest component of the discard stream. Composting can cut the discard stream by almost half in a relatively short time period. The beauty of composting is that it can be accomplished inexpensively via low-tech means on a small-scale. More often than not, it can be done with local know-how and local resources. Keeping materials segregated is essential to success.

This report:

- discusses the history of municipal solid waste incineration, its fall from grace, and how incinerator companies are seeking new markets for their obsolete technology,

- identifies jurisdictions restricting or banning municipal solid waste incineration,

- lists some of the many communities fighting planned incinerators,

- details 20 reasons incineration is a losing financial proposition for host communities inindustrializing nations,

- provides a checklist for evaluating a proposed municipal solid waste incinerator project,

- debunks some common myths about incineration,

- summarizes the growing zero waste movement,

- presents non-incineration discard management strategies (focusing on replicable recycling and composting techniques),

- shares information on some model recycling and composting programs operating successfully in the global South,

- highlights the unique and important role of the informal sector in recovery activities, and

- outlines ten steps to get started on the path to zero waste.

This report does not address the growing push to burn industrial toxic materials or health care waste in the global South. It also does not focus on the serious environmental problems incineration poses. Environmental and public health impacts are addressed in other resources such as Greenpeace's 2001 report, "Incineration and Human Health: State of Knowledge of the Impacts of Waste Incinerators on Human Health."[3] Information on medical waste management is available from Health Care Without Harm, *www.noharm.org*. Information on toxics use reduction and clean production are available from Clean Production Action at *www.cleanproduction.org*.

Incinerator companies seek new markets

(often in the global South) for their obsolete technologies

"In this century of progress, with our knowledge of chemistry, and with the most complete machinery at our disposal, it seems to me like a lapse into barbarism to destroy this most valuable [organic] material simply for the purpose of getting rid of it, while at the same time we are eager to obtain these very same materials for our fields by purchase from other sources."

- Chemist Bruno Terne
*speaking at Philadelphia's Franklin Institute in **1893**, argued against wasting natural fertilizers in incinerators while extracting and transporting fertilizers from continent to continent.*

Source: [Bruno Terne], "The Utilization of Garbage," *American Architect and Building News* (Sept. 23, 1893), pp. 185-86, as cited by Susan Strasser, *Waste and Want: A Social History of Trash* (Metropolitan Books, Henry Holt and Co, LLC: NY, U.S., 1999) pp. 133-134.

Burning of discards has probably been practiced by mankind since shortly after the discovery of fire, but the modern era of waste incineration was inaugurated in 1874 when, in Nottingham, England, "the Destructor" became the first facility designed to systematically incinerate trash.[4] The United States adopted the technology in 1885 with the construction of a garbage incinerator on Governor's Island, New York. Within 25 years, Americans built more than 180 incinerators to burn their trash. In 1905, New York City improved upon the simple incinerator by using the heat of combustion to generate electricity to light the Williamsburg Bridge. But the tide was already turning against incineration. By 1909, 102 of the incinerators built in the United States since 1885 had been abandoned or dismantled. The availability of land for dumping and the high ash content (from the use of coal as fuel for heating) in typical urban discards made waste dumping cheaper and more practical. The dumps evolved into "sanitary landfills," which remain the predominant method of disposal in the United States.[5] Waste incinerators enjoyed a renaissance in the 1970s during the U.S. energy crisis. Reincarnated as "waste-to-energy facilities," incinerators were touted as a modern technology with the double benefit of making waste "go away" while producing heat and/or electricity.

In Europe, early incineration facilities were based on English technology. Around the beginning of the twentieth century, incinerators were established throughout continental Europe, especially in Germany and major cities such as Brussels, Stockholm, and Zurich. A wave of construction of

new waste incinerators took place in the 1960s and 1970s to handle the growing discard stream that resulted from increased consumerism and use of disposable products.[6]

By the 1980s, the tide began to turn against incineration in many industrialized nations. As awareness of the environmental effects and true economic costs of burning resources in waste incinerators grew, citizens and environmental health advocacy organizations began fighting these facilities in earnest, while governments have been implementing stringent rules concerning their operation. Between 1985 and 1994, at least 280 U.S. incinerator projects were cancelled.[7] Numerous European cities have also backed away from planned or proposed incinerators.[8] Furthermore, new pollution control regulations have forced the closing of many existing incinerators. For example, new European Union guidelines implemented in 1996 resulted in the closing of 23 of the 28 operating incinerators in the U.K. More recently, in Japan, 509 waste incinerators are slated to close because of stricter dioxin emission standards which took effect in 2002. From December 1998 to May 2002, 170 Japanese facilities were deactivated, unable to meet the new standards. Another 339 incinerators were slated to close in 2002.[9]

Several jurisdictions have banned incineration or the building of new incinerators (see Table 2). The Philippines may be the only country with a national ban.

In the face of growing opposition to expanding business in the U.S., Canada, and Europe, the waste incineration industry has looked to industrializing nations as a new market in which to sell its toxic and expensive product. The Belgian incinerator company Indaver, for example, has been denied permission to build at least one mass burn incineration facility in the Flemish part of Belgium and is now pursuing more environmentally friendly technologies there such as anaerobic digestion with biogas production. However, the company continues to peddle its polluting mass burn technology outside Belgium.[10]

Dozens of incinerators are currently proposed in industrializing nations. Companies seeking to build these incinerators include Onyx (a subsidiary of the French company Vivendi Environnement), Australia's Energy Developments Ltd (EDL), Belgium's Indaver, USA's Olivine, USA's Ogden Martin, and USA's Wheelabrator. Table 3 lists some of the many incinerator projects proposed around the globe. Many of these are in the global South.

Table 2: Jurisdictions banning or restricting municipal solid waste incineration

Jurisdiction	Date	Description
USA		
West Virginia	1993	West Virginia Law, H.B. 2445: "it shall be unlawful to install, establish or construct a new municipal or commercial solid waste facility utilizing incineration technology for the purpose of solid waste incineration."
Rhode Island	1992	Rhode Island has banned incineration until the state reaches 70% recycling. RI's State Senate Act 92-S 2502 states: "...incineration of solid waste is the most costly method of waste disposal with known and unknown escalating costs which would place substantial and unreasonable burdens on both state and municipal budgets to the point of seriously jeopardizing the public's interest."
Delaware	1998	SB 98: This bill bans garbage incineration in Delaware's "Coastal Zone."
Massachusetts	1992	Enacted a moratorium on new construction or expansion of solid waste incinerators.
Louisiana	2000	Louisiana revised its statute Title 33: "…no municipality with a population of more than five hundred thousand shall maintain any municipally owned, operated, or contracted garbage plants or incinerators in any area of the municipality zoned for residential or commercial use."
Alameda County, California	1990	The Alameda County Waste Reduction and Recycling Act of 1990 states "refuse incinerators are a poor alternative to source reduction and recycling: such incinerators damage the environment by wasting natural resources that could instead be recycled, by accelerating the release of greenhouse gases – which worsen global warming – and by generating toxic substances." One of the purposes of the Act is to "prohibit the incineration of refuse within Alameda County."
Anne Arundel County, Maryland	2001	The County Council passed Bill No. 40-01, which prohibits waste and medical waste incinerators in the county.
City of Berkeley, California	1982	City voters passed a ballot initiative banning garbage-burning plants for 5 years (11/82 to 12/87). The initiative stated in part, "The City of Berkeley shall not construct, own, or operate a garbage-burning plant within the City of Berkeley. The City of Berkeley shall not permit a garbage-burning plant to be constructed or operated within the City of Berkeley." The moratorium allowed the city to develop recycling programs (now national models). No incinerator has been built in Berkeley.
City of Chicago, Illinois	2000	The city passed an ordinance amending the Chicago Municipal Code. The amendment reads in part: "It shall be unlawful to install or replace a municipal waste incinerator in the City of Chicago after June 1, 2000. Beginning on August 1, 2000, all existing municipal solid waste incinerators in the City of Chicago shall cease operation and the burning of municipal waste shall be strictly prohibited except where required by state or federal law."
City of San Diego, California	1987	A city ordinance that stipulates waste incinerators cannot be sited within a certain radius of schools and daycare centers resulted in no eligible land being available in the city.
Canada (Ontario)	1992	In 1992, the provincial government of Ontario banned new municipal waste incinerators. In 1996, the newly elected government overturned the ban as part of its deregulation policy. However, the Ontario recycling industry is lobbying to maintain the ban.
Greece	1994	In October 1994, Greece passed a law on renewables and power generation by the private sector. The law made it illegal to burn hazardous waste in "waste-to-energy" plants and also banned the burning of solid fuels (except biomass) in new power plants.
Brazil (the municipality of Diadema, State of São Paulo)	1995	Diadema approved a law banning incinerators for municipal waste. The council stated that the waste problem should be tackled using reduce, reuse, and recycling policies.
The Philippines	1999	The Clean Air Act explicitly bans all types of waste incineration.
Belgium	1990/1997/ 2000	In the Flemish-speaking part of Belgium, public pressure resulted in a 5-year moratorium on the permitting of new municipal waste incinerators (1990). In 1997, the Flemish environment minister announced a moratorium on building new waste incinerators. As of July 1, 2000, Flanders has a policy prohibiting burning of unsorted waste.
India	2000	India has a partial ban on burning municipal solid waste. Schedule IV, Emissions Standards, of the Municipal Solid Waste Rules, 2000, states "chlorinated plastics shall not be burned."

Sources: Institute for Local Self-Reliance, Washington, D.C., U.S., 2004; Marcia Carroll, Multinationals Resource Center, Washington, D.C., U.S., personal communication, October 2001; Kathy Evans, Ecology Center, Berkeley, California, U.S., personal communication, October 2001; Anu Agarwal, Project Officer, Srishti, New Delhi, India, personal communication, October 2001; Pawel Gluszynski, Waste Prevention Association, Krakow, Poland, personal communication, October 2001; Bharati Chaturvedi and Ravi Agarwal, "No Fire Without Smoke," Srishti, New Delhi, India, 1996; and Fred De Baere, Belgian Platform Environment & Health, Nieuwkerken Was, Belgium, personal communication, October 21, 2001.

Table 3: Some of the many incinerators proposed around the world

Locality	Capacity (tonnes per day)	Capital Cost	Technology	Broker/Constructor	Financing
Perth, Australia				Olivine (USA)	
Shanghai, China	1500	US$86 million	Mass Burn	(Spain)	NA
Dongguan City, China	900	US$50 million	Mass Burn	Unknown	International
Shenzhen, China	1200	Unknown	Mass Burn	SEGHERS (Belgium)	Public
Split, Croatia	NA	Unknown	Pyrolysis	PKA-Pyrolyse Kraftanlagen GmbH (Germany)	Public
Assam, India				Sarbanand Impex	
Bhopal, India	500	Unknown	Pyrolysis	Bhopal Environmental Projects (EDL India)/Municipal Corp. of Bhopal	
Chennai, India (formerly Madras)	600	US$41 million	Pyrolysis	Energy Developments Ltd. (EDL)/SWERF technology (Australia)	Public-private
Jaipur, India	500	US$29.1 million (Rs 141.87 crore)	Pyrolysis	EDL India (Australia)/ Jaipur Municipal Corporation	
Mumbai, India (formerly Bombay)	1,000	Unknown	Pyrolysis	EDL India (Australia)/Municipal Corp. of Greater Mumbai	
Ringaskiddy, County Cork, Ireland	100	US$86.8 million (IR pound 75 million)	Mass Burn	Indaver (Belgium)	Private
Ireland				MC O'Sullivan (Irish)/COWI (Danish)	
Bishkek, Kyrgyzstan	NA	Unknown	Mass Burn	ITI Italy	International
Selangor, Malaysia	1,500	US$315.8 million	Mass Burn	Ebara, Japan	NA
Lublin, Poland	~375	US$30 million	Mass Burn	Ramboll & Hannemann A/S (Denmark), Environmental Resources Ltd. (UK)	Public
Arecibo, Puerto Rico	1,800	US$225-250 million	Mass Burn	RENOVA	
Caguas, Puerto Rico	2,500	US$500-700 million	Pyrolysis/ incineration	Thermoselect	
Aberdeen, Scotland				SITA (French)	
Port of Koper, Slovenia	~12	Unknown	Pyrolysis	KIV Vransko (Slovenia)	Public-private
Seoul, South Korea	13 planned	Various	Mass Burn	Japan Int'l Cooperation Agency	Public
Kwangju, South Korea	400	US$46.8 million (60 billion won)	Mass Burn	SK (Korean conglomerate) with Seghers (Belgium) furnace	Public
Pusan, South Korea	200	US$66.4 million (85 billion won)	Mass Burn	Stein Industries (France)	Public
Chung Lie City, Taiwan	1,350	US$ 133 million (NT4.6 billion)	Mass Burn	Evergreen Heavy Industrial Corp. (Taiwan, USA)	Public
Tambon Nong Yai, Thailand	Unknown	US$20.4 million (900 million baht)	Mass Burn	Unknown	Public

NA = not available
Source: Institute for Local Self-Reliance, Washington, D.C., U.S., 2002; GAIA's Waste Incineration Database maintained by Pawel Gluszynski, Waste Prevention Association, Krakow, Poland; Juan Rosario, Mision Industrial de Puerto Rico, San Juan, Puerto Rico, personal communication, November 19, 2001; and Gopal Krishna, Toxics Link, India, personal communication, September 2, 2002.
For more information, contact info@no-burn.org

Twenty reasons why incineration is a losing financial proposition for host communities

Waste incineration has myriad problems and almost all pose financial burdens to host communities, especially those in industrializing nations. Here are 20 reasons why incineration is a losing financial proposition for host communities:

1. Incineration is the most costly discard management option.
2. Incinerators contribute to countries' indebtedness.
3. Incinerators are capital-intensive rather than labor-intensive.
4. Wet organic materials, common in southern countries, may reduce the capacity of or shut down incinerators.
5. Incineration will adversely impact the informal sector and the informal sector will diversely impact incineration.
6. Energy revenues from incinerators are often over-estimated.
7. Incinerators may require transfer stations, another cost.
8. Pollution control equipment and pollution regulation and enforcement are expensive and increase costs.
9. Incinerators produce a toxic ash that requires disposal in engineered landfills, significantly adding to costs.
10. Incinerators often receive far less tonnage than they were designed to process, leading to financial problems.
11. Lack of infrastructure in lesser industrialized countries may doom incinerators to financial failure.
12. Citizens and taxpayers pay for incinerators' financial problems.
13. Incinerators hamper least-cost options such as recycling
14. Incinerators not only put the livelihoods of wastepickers at risk, but they also reduce overall employment and business opportunities from reuse and recycling.
15. Incineration consultants and "experts" can add millions to the costs.
16. Incineration's high investment costs increase potential for corruption.
17. Incineration has high public health costs.
18. Incineration wastes resources and energy.
19. Incinerators lower property values.
20. Incineration encourages continued waste generation, diverts attention from real clean production and zero waste solutions, and reinforces the notion that unwanted discards are a local community responsibility and cost.

Phuket Municipal Solid Waste Incinerator, Thailand.
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1. Incineration is the most costly discard management option

Costs of any discard management system will depend on a number of factors including the type of technology chosen; characteristics of materials discarded; land, labor, and energy costs; and financing costs. Even so, incineration is consistently more expensive than other options. It is a highly complex technology that requires large capital investments and incurs high operating costs. Furthermore, projects proposed in industrializing nations require a large share of foreign currency.

According to 2000 World Bank report, capital and operating requirements for incinerator plants are at least twice the costs required for landfills. The report found, for instance, that net treatment costs per tonne incinerated will range from US$25-$100 (in 1998) with an average about US$50. The net costs for landfilling ranges from US$10-$40, depending on design (such as the number of membranes and level of leachate treatment).[11] This net treatment costs represents annual capital costs plus operating costs minus energy revenues. For incineration, annual costs for paying back the capital investment can represent more than half of net treatment costs.

Incinerators are at least two times more expensive than landfills.

Recently cancelled incinerators

Wyszkow, Poland: This 22,000 tonne-per-year municipal solid waste incinerator was initially proposed to reduce disposal to a local dump which had exceeded its capacity. However, the proposed incinerator was oversized – Wyszkow disposes less than 5,000 tonnes each year. A report by the incinerator company showed that, in order to fill the incinerator, additional materials would have to be imported from surrounding communities, and, ironically, the quantity of post-incineration residues would be over 10,000 tonnes per year, more than twice the tonnage amount the community was currently disposing. Non-governmental organizations and a citizen group lobbied local authorities and succeeded in getting the project cancelled.

Zakroczyn, Poland: The city council of this community rejected a proposed municipal solid waste and hazardous waste incineration plant. The council stated that "the waste incinerator would change [the] whole character of the county where local community life depends on agriculture and agrotourism," and "Zakroczym inhabitants would have [difficulty in selling] their food products as [it is] common opinion [that] the county would be polluted by the incinerator."

On nut, Thailand: Early in 2001, the governor of Bangkok decided to terminate this project citing toxic pollution and the burden of massive debt repayments and expensive operational costs as reasons for its cancellation. Again, in August 2003, the Bangkok governor rejected the proposal due to exorbitant costs involved.

Chennai, India: In October 2002, The Tamil Nadu Pollution Control Board announced it is unlikely to clear the way for a proposed 600 tonne-per-day pyrolysis gasification facility. The facility was slated to use the Energy Developments Ltd. (EDL) technology and cost US$41 million. Senior Board officials maintain that the EDL project is capital intensive, highly polluting, will release dioxins and furans (which are difficult to measure), and that the nascent Australian technology has not been proven reliable. The project has been shelved.

Source: GAIA's Waste Incineration Database maintained by Pawel Gluszynski, Waste Prevention Association, Krakow, Poland; and S. Gopikrishna Warrier, "TNPCB May Not Grant Nod for Waste Project," *Business Line* (November 1, 2002); and Gopal Krishna, Toxics Link, India, personal communication, November 26, 2002.

The World Bank report concluded that:

> *"…the net treatment cost per metric ton of waste incinerated is normally at least twice the net cost of the alternative controlled landfilling. At the same time, when applying waste incineration, the economic risk in case of project failure is high…"* [12]

Capital costs of incineration

The capital investment for incinerators usually runs in the multi-million dollar range. Typical investment costs for a mass burn municipal solid waste incinerator plant in industrializing countries would range from approximately US$50 million to $280 million depending on the capacity of the plant.[13] These figures correspond to US$136,000 to US$270,000 per tonne-per-day of installed capacity. Information from actual incinerator proposals indicates that costs may be significantly higher than these World Bank figures. Table 4 illustrates the high capital costs for some incinerators operating and proposed around the globe. Capital costs are as high as US$1,750,000 per tonne-per-day of installed capacity. Even at these exorbitant prices, most incinerators proposed or operating in the global South would not meet the environmental standards in the United States or Western Europe. The costs for many of the facilities listed in Table 4 could double if installed with advanced pollution control equipment.

In Japan, fiscal year 2000 costs for the country's newly adopted incineration projects totaled 800 billion yen (approximately US$7 billion). These costs included expenditures for constructing new facilities as well as upgrading existing facilities with emission gas control.[14] A discard management system involving high capital investments is less flexible than systems with lower costs. Capital costs are fixed costs. They cannot be lowered by improving efficiency or design as is the case with many waste prevention, reuse, recycling, and composting programs.

Table 4: Capital costs of selected incinerators around the globe

Locality	Status	Capacity (tpd)	Capital Cost	Capital Cost (US$)	Capital Cost/tpd Capacity (US$)
Dongguan City, China	Unclear	900	US$50,000,000	$50,000,000	$55,600
Shenzen, China	Operating	300	Yuan1.2 billion	$145,000,000	$483,300
Shanghai, China	Approved	1500	US$86 million	$86,000,000	$57,300
Chennai, India	Approved	600	Rs$2000 million	$41,000,000	$68,100
Ringaskiddy, Ireland	Proposed	100	IR pound 75 million	$86,800,000	$868,000
Tokyo, Japan	Operating	400	US$700 million	$700,000,000	$1,750,000
Ibaragi Prefecture, Japan	Operating	180	18 billion yen	$149,100,000	$828,300
Lublin, Poland	Proposed	~375	US$30 million	$30,000,000	$80,000
Ixopo, South Africa	Operating	10	US$60,000	$60,000	$6,000
Kwangju, South Korea	Not operating	400	60 billion won	$46,800,000	$117,000
Sanggye-dong, South Korea	Operating	800	80 billion won	$62,500,000	$78,100
Pusan, South Korea	Proposed	200	85 billion won	$66,400,000	$332,000
Suwon, South Korea	Operating	600	90 billion won	$70,300,000	$117,200
Chung Lie City, Taiwan	Approved	1,350	NT$4.6 billion	$133,000,000	$98,500
Kaohsiung, Taiwan	Implemented	1800	NT$6.9 billion	$199,500,000	$110,800
Kaohsiung, Taiwan	Implemented	900	NT$3-4 billion	$101,200,000	$112,400
Tainan Town West, Taiwan	Implemented	900	NT$3.8 billion	$109,900,000	$122,100
Phuket Island, Thailand	Operating	250	780 million baht	$17,650,000	$70,600
Tambon Nong Yai, Thailand	Proposed	Unknown	900 million baht	$20,400,000	Unknown
Guam, U.S.	Proposed	~15	US$13.2 million	$13,200,000	$880,000

tpd = tonnes per day
Note: Costs have been converted to US$ using August 2001 rates posted on the Universal Currency Converter Web site at: ttp://www.xe.com/ucc

Source: GAIA's Waste Incineration Database maintained by Pawel Gluszynski, Waste Prevention Association, Krakow, Poland.
For more information, contact info@no-burn.org.

Table 5: Capital costs of incineration versus recycling and composting

	Type of Program	Capital Cost/tpd Handled (US$)
Recycling/composting: Industrialized Nations		
typical recycling facilities in U.S.	sorting recyclables	30,000
low-tech recycling facilities in U.S.	sorting recyclables	4,000-20,000
low-tech, small-scale composting in U.S.	yard waste composting sites	5,000-13,000
large-scale composting		5,600-90,000
Recycling/composting: Less Industrialized Nations		
Escopa 2, the Philippines	recycling/organics collection + composting	5,000
Sun Valley, the Philippines	recycling/organics collection + composting	1,800
Exnora Program, India	recycling/organics collection + composting	1,650
Mokattam (Cairo), Egypt	recycling micro-enterprises	450
Rio de Janeiro, Brazil	14 recycling cooperatives	5,300
Low-tech, small-scale composting	backyard/neighborhood sites	negligible
Incineration	incineration	136,000-270,000

tpd = tonnes per day

Sources: Institute for Local Self-Reliance, Washington, D.C., U.S., 2004. Incineration costs are from T. Rand, J. Haukohl, U. Marxen, *Municipal Solid Waste Incineration: Requirements for a Successful Project*, World Bank Technical Paper Number 462, The World Bank, Washington, D.C., U.S., June 2000. Large-scale composting costs are based on data in Argonne National Laboratory, "Energy and Environmental Systems Analysis: Technology Summary I.1: Landfills: Reducing Landfilling Of Waste," 1993.

Comparing capital costs of incineration versus recycling and composting

Recycling and composting facilities are far cheaper than incinerators. This is true whether systems are low or high tech, mechanized or more labor-intensive. Table 5 compares the capital costs of incineration with a variety of recycling and composting programs.

In the U.S., capital costs of recycling facilities average about US$30,000 per tonne per day of capacity and depend on the level of automation. Low-tech recycling processing facilities use basic equipment such as conveyors, forklifts, balers, plastics compactors, plastics granulators, and/or can crushers. One study indicated that low-tech facilities in select U.S. communities cost US$4,000 to $20,000 per tonne per day of capacity.[15] Many of these communities have kept costs down by utilizing used equipment.

In industrializing nations, where recycling operations tend to be less mechanized and more labor-intensive, investment costs can be expected to be far lower than the US$30,000 per tonne per day U.S. average. Rio de Janeiro, Brazil, is a good case in point. According to Elinor Brito, manager of Rio de Janeiro's cooperatives of scavengers and recycling coordinator at the city's cleaning authority, "Little data is available in this area, but what we have indicates that the creation of jobs in the recycling industry requires little investment when compared to other sectors of the economy.…In Rio, each waste separation unit costs on average US$25,000 and employs around 20 people. Currently we have fourteen cooperatives producing 2,000 tonnes of separated recyclable material per month and employing 414 workers."[16] On a tonne-per-day handled basis, the equipment for this recycling system in Brazil cost approximately US$5,300. This is at least 26 times cheaper than the average equipment cost for incinerators.

A number of projects in Egypt exemplify the labor-intensive and low-capital nature of recycling activities in industrializing countries. For every 10,000 tonnes per year sorted, about 89 workers are employed.[17] In the U.S., for this tonnage, only 11 jobs would be created.

In Cairo, the informal sector collects one-third of the city's household discards—about 988,400 tonnes per year. Of this tonnage, 80% is recovered. One neighborhood surrounding Cairo, Mokattam, is home to 928 enterprises that collect and sort materials into 16 categories utilizing virtually no equipment, with the exception of their trucks. They sell sorted materials to intermediary traders and recycling workshops. Mokattam's 228 small-scale recycling industries or workshops have invested LE 1,805,350 (US$426,000) in equipment. This translates to about LE 1,900 (~US$450) per tonne-per-day handled.[18] The local Cairo government does not incur any of the costs to recover almost 791,100 tonnes per year. These costs are entirely paid for by the informal sector.[19] (For more information on Cairo's informal recycling sector, see pages 37-38.)

Composting facilities can cost less than recycling operations. They can be very small scale and low tech, taking place in residents' backyards or on the neighborhood level. Larger facilities can be low tech too, involving little more than a front-end loader to turn piles of composting organics. Higher-tech composting can involve in-vessel systems, which are enclosed and temperature and moisture controlled.

In the U.S., low-tech yard waste composting operations range from US$5,000 to $13,000 per tonne per day of throughput.[20] Costs depend on size of operation and equipment utilized. Some of these operations may have nothing more than a chipper and a front-end loader. Others may have a tub grinder, a windrow turner, and/or a shredder-mixer. Low-tech yard waste composting sites are generally small scale, handling under 10,000 tonnes per year.

Backyard composting is the lowest tech and smallest scale of all composting techniques available. Costs for backyard composting amount to nothing more than the costs of household composting bins.

Composting can also be done on a large scale. One study found that large-scale composting facilities (270 to 500 tonnes per day) can range from US$1.5 million to $45 million depending on their actual tonnage capacity and complexity.[21] These figures correspond to US$5,600 to US$90,000 per tonne per day of capacity, which still are far less than the capital costs for municipal waste incinerators.

Decentralized low-tech composting operations in the global South can have equipment costs 75 times less than incinerator investment costs.

In the global South, there are numerous examples of successful small-scale composting programs at the home and the community levels. In India, for example, the nonprofit Exnora International's decentralized community-based composting and recycling program requires an equipment investment as low as US$1,650 per tonne-per-day recovered. About 90% of household discards is diverted under its program. (For more information on this program, see pages 47-51.) A similar composting program in Barangay Sun Valley, the Philippines, costs about US$1,800 per tonne-per-day composted (see page 53). This is 75 times less than the investment required by incineration. Communities in the global South can start composting with virtually no start-up costs and equipment. In India, many of the successful programs involve nothing more than digging a trench for worms to compost organic discards. The trenches are often dug in people's backyards and in vacant space. The only expense may be plastic buckets for households to collect their organics.

Incinerators Have the Highest Operating Costs

Per tonne operating costs for recycling and composting programs are almost always far lower than operating costs for incinerators. In addition, the higher the recycling and composting levels, the more cost-effective the program.

One issue often overlooked when comparing the costs of recycling/composting to incineration is that costs for the former include collection costs. Recycling and composting program costs typically include collection costs as well as sorting and composting system costs. In contrast, operating costs for incinerators are in addition to collection costs. In industrializing countries with decentralized recycling and composting programs in which collection workers use pedicabs/cycle carts, local government can realize significant savings from the avoided cost of collecting trash with trucks. Trash collection using trucks is often the most expensive element of solid waste management operating costs, and incineration virtually requires this type of infrastructure. Fuel, driver and truck fleet supervision, truck depreciation, truck driver salaries all cost money. Exnora International's decentralized recycling/composting approach in India exemplifies this point. Workers collect segregated organics and recyclables in a three-wheeled cycle cart and sort them at decentralized "zero waste" centers. For a program serving 200 families, worker wages and maintenance of a cycle cart and a zero waste center is about US$50 per month. In contrast, the local government spends approximately US$400 per month to collect, transport, and dispose of waste from 200 families. An incinerator system would significantly increase these disposal costs.

2. Incineration increases the indebtedness of host countries

Capital costs of incinerator projects drain the resources of local economies and increase the indebtedness of industrializing countries in two primary ways. The first, and most obvious, is the need for foreign financing to build and maintain such facilities. These costs are not limited to the construction phase, as countries need to have access to foreign currency to purchase equipment for facility repairs and upkeep. The World Bank estimates that at least 50% of the investment costs will need to be covered by foreign currency.

The crippling nature of incinerator debt is illustrated by an incinerator proposal made in Miljoteknik Zychlin, Poland, in the early 1990s. The project was stopped after an analysis by a local environmental group revealed that repayment of the debt for the US$5 million facility would have taken the community of 14,000 residents over 100 years! In another example, a municipal solid waste incinerator in Budapest, Hungary, operated under capacity for at least ten years after it was put into operation in 1982. The plant had experienced numerous enduring breakdowns because of a poorly designed steam-boiler. In spite of the facility's poor performance record, the municipal government retrofitted the plant at a cost of DM25 million (US$11.6 million) using German credit.[22]

In Thailand, one project proposes to burn Bangkok's waste in four Japanese-funded incinerators, each with a daily capacity of 1,300 tonnes at a cost of 20,000 million Thai Baht (US$540 million). The amount would be given as a soft loan to the Thai government for the purchase of Japanese incinerators. In 1998, Japan provided Thailand with 117,562 million yen in broad economic development loans targeted to aid in the economic recovery of Thailand after the Asian economic crisis. In 1999, Japan's Overseas Development Assistance program provided additional large loans. These loans are being used as leverage to push Japanese incinerator technology in Thailand.[23]

The second impact incinerators have on industrializing nation indebtedness is encouraging continued reliance on manufactured products from other nations. In fact, this is true for all countries. Incinerators destroy resources, such as paper, plastics, textiles, and organic materials, that could be composted or re-manufactured into new products. Instead of allowing nations the opportunity to develop new industries and reduce foreign imports, incinerators transform these resources into smoke and ash.

In the U.S., on a per tonne basis, sorting and processing recyclables alone sustains 11 times more jobs than incineration.

3. Incineration is capital-intensive rather than labor-intensive

Incineration is a capital-intensive technology that uses little labor. A municipal waste incinerator sustains one full-time job for every 10,000 tonnes per year of capacity. Recycling tends to be less capital-intensive and more labor-intensive. A typical recycling sorting facility in the U.S. sustains eleven jobs for every 10,000 tonnes per year of capacity and even more jobs in less-mechanized plants. In Cairo, Egypt, for example, where 998,400 tonnes per year are sorted by hand using virtually no equipment, the equivalent of 89 workers are employed for every 10,000 tonnes per year sorted. Composting facilities in the U.S. maintain about four jobs for the same tonnage throughput.[24]

Industrializing countries tend to be poor in capital and rich in labor. Thus, the capital-intensive nature of incineration does not transfer well to industrializing countries.

4. Waste composition affects incinerator operation and finances

Most waste incinerators were designed and tested in industrialized countries and, as such, are far less suitable for the discard stream in industrializing countries. For example, the material stream entering an incinerator must have a minimum energy content in order to maintain "proper" combustion. This is often not the case in the global South. In general, discard streams in industrializing countries and the global South are usually more dense and have a higher moisture content than the discard streams in northern industrialized nations. For example, the moisture content of discards produced in a city like New York is about 22%, whereas, surveys have revealed waste moisture content in Singapore at 40%, Bangkok at 49%, and Bandung, Indonesia at 80%.[25] Table 6 shows the high moisture content of discards in select Asian cities. Discard streams in industrializing countries may also have a higher portion of inert materials such as ash and grit, which have no energy value. High-moisture content materials are often too wet to burn on a self-sustaining basis, requiring the input of another fuel. An incinerator in Surabaya, Indonesia, can only operate at two-thirds of its design capacity, because the wastes need to be dried on-site for five days to make them incinerable.[26] A New Delhi, India, incinerator was closed within a week after its completion in 1986 because the garbage from the surrounding communities was too wet to burn. The facility cost more than US$10 million to build.[27]

5. Incineration will adversely impact the informal sector and the informal sector will adversely impact incineration

In communities with a large informal recycling sector, introducing incineration will force landfill wastepickers to shift their operations from the end of the waste chain to the beginning. This will affect the composition and quantity of material projected available for burning and thus could contribute to tonnage shortfalls and affect burnability of the waste. Wastepickers will continue to remove the most valuable materials. Some of these materials

Table 6: Solid waste moisture content in selected Asian cities

	Moisture content (%)
Low-income countries	
Chongqing, China	42.5
Dalian, China	49.7
Middle-income countries	
Bangkok, Thailand	49.1
Chanburi Municipality, Thailand	56.3
Rayong Municipality, Thailand	46.7
Metro Manila, the Philippines	45.0

Source: Daniel Hoornweg, "What a Waste: Solid Waste Management in Asia," The World Bank, Washington, D.C., U.S., May 1999.

(such as wood) also have a high-energy content and undoubtedly are material that incinerator planners rely on for the incinerators. Incinerator planners rarely factor in wastepicking.

Futhermore, incinerators will impose hardships on if not jeopardize wastepickers' livelihoods.

6. Energy revenues from incinerators are often over-estimated

Incinerator proponents often over-estimate anticipated revenues from energy sales, resulting in higher than anticipated per-tonne costs to operate the facility. Numerous U.S. incineration projects have run into trouble because project developers over-estimated projected electricity revenues or local utility companies balked at buying power from the incinerator. Often revenues anticipated in bond proposals to build incineration plants overstate the revenue from sales of electricity. When revenues are lower than projected, incinerator operators must make up for the shortfall. They do this by passing the costs onto garbage customers through higher incinerator "tip" fees or onto electricity customers through charging artificially high prices for the electricity generated. In addition, the plants themselves can consume a significant portion of their generated electricity. For example, the Tainan Town West incinerator in Taiwan consumes nearly one quarter of its own electricity generation and a facility in Ryugasaki Ibaragi Prefecture, Japan, actually consumes more energy than it produces.[28]

7. Incinerators may require transfer stations, another cost

Incineration requires a centralized waste system. Waste is collected and taken to one site, the incinerator. Very large incinerators tend to serve large urban or geographical areas and typically require the building of waste transfer stations. Thus, waste haulers can deliver waste to the nearest transfer station, where the waste is transferred to larger vehicles for transport to the incinerator. Transfer stations, while generally low-tech, will add to the costs of the incineration system. In addition, they make poor neighbors as they are noisy, add truck traffic to the roads, attract vermin, and litter the area. In Puerto Rico, using a proposed transfer station to serve a proposed incinerator would have cost up to 100% more than hauling the trash directly to the incinerator.[29]

8. Pollution control equipment and pollution regulation and enforcement are expensive and increase costs

Incinerators are major contributors to air pollution in surrounding areas. These facilities can release pollutants such as dioxins, heavy metals, oxides of nitrogen, sulfur oxides, particulate matter, and numerous volatile organic compounds into the atmosphere.

Neither high temperatures nor pollution control equipment can make incinerators safe.

Dioxin is a cancer-causing persistent organic pollutant and one of the most toxic substances known to science. High-temperature incineration is often falsely advocated as a technology that eliminates dioxin emissions. The idea is to make the furnace hot enough to break down dioxins. However, even incinerators with extremely hot furnaces produce large quantities of dioxin. Dioxin is an extremely stable molecule and will re-form as the exhaust gases cool. This is called post-combustion formation of dioxin. Most dioxin emissions from an incinerator are from post-combustion formation.[30]

Pollution control equipment does not eliminate pollution, it mostly traps it and concentrates pollutants shifting most, but not all, of the pollution from the exhaust gas to other environmental media. Thus, "cakes" from baghouse filters or particulates from electrostatic precipitators contain dioxins, heavy metals, and other toxic chemicals. They must be treated as hazardous waste, thereby adding further to the cost of disposal.

Neither high temperatures nor pollution control equipment can make incinerators safe.

In industrialized countries, incinerator air pollution control equipment lessen the release of many air pollutants but they also increase costs significantly. The better the pollution control and regulatory oversight, the higher the costs. In the United Kingdom for example, around 30% of the capital costs of a conventional British incineration facility is attributable to the flue gas clean-up system.[31] In the Netherlands, a 1,800 tonne-per-day facility, which went on line near Amsterdam in 1995, cost US$600 million with half the investment going into air pollution control.[32] In the United Kingdom, owners of the Sheffield incinerator spent over 28 million pounds (~US$40 million) bringing the facility up to the new European standards. As a result, the local government council can no longer afford to service the debt on it and plans to sell it.[33] In Korea, safety requirements have doubled the construction cost of incinerators from 100 million won (~US$90,000) per tonne-per-day of capacity in the early 1990s to 200 million won (~US$180,000) per tonne-per-day of capacity in recent years.[34]

Public concern over environmental impacts of waste incineration has forced plant owners and operators to install high-cost advanced pollution control devices.

Increased emission control standards in the United States have required incinerator owners and operators to spend millions of dollars to update older, more polluting facilities. Yet, modern incinerators with expensive "state-of-the-art" pollution control devices still do not eliminate or adequately control toxic emissions from today's chemically complex municipal discards. The heterogeneous mixture of natural and synthetic materials that comprises the urban discard stream undergoes a variety of chemical reactions during and after combustion. Even new municipal solid waste incinerators emit toxic metals, dioxins, and acid gases. Far from eliminating the need for a landfill, they produce an ash residue that is toxic. Incinerator ash poses a health hazard. It contains dioxins and dangerous heavy metals such as lead, arsenic, and mercury.

Byker incinerator in UK. © Ralph Ryder/CATs

Incinerator ash contaminates community in Newcastle, U.K.

Between 1994 and 1999, the Newcastle City Council spread 2,000 tonnes of ash from a refuse-derived-fuel incinerator in Byker, Newcastle on footpaths and community garden allotments. Newcastle University laboratory tests of soil samples from the allotments revealed dioxins and heavy metals in quantities far in excess of safety levels. In April 2000, the Newcastle City Council advised residents that children should not be allowed to play near the garden allotments, eggs and animal produce from the sites should not be consumed, and vegetables grown on them should be washed and peeled before eating. In January 2002, both the New Castle City Council and the plant operator, Contract Heat and Power, were prosecuted and fined for offenses relating to the spreading of ash.

Source: Environmental Data Services Ltd., "Regulatory foul-ups contributed to Byker ash affair," The ENDS Report, May 2000, Issue Number 304, London, England and Environmental Data Services Ltd., "Agency and incineration firm face flak over fly ash recycling," The ENDS Report, December 2000, Issue Number 311, London, England. Both available at <http://www.endsreport.com/issue/index.cfm>. The Journal (New Castle, UK), "Toxic ash controversy sparks major rethink," January 5, 2002.

An essential aspect of regulatory oversight is the need for continuous monitoring of key pollutants and regular stack testing for dioxins, furans, heavy metals, and particulates. These systems are essential to ensure compliance with regulatory emission limits. However, installing continuous monitoring systems and conducting stack tests are very expensive. Moreover, few countries have the technical resources to sample and analyze for dioxins and furans at low concentrations. Thus, stack samples have to be shipped to laboratories in industrialized countries for analysis. These costs, although substantial, are often not included in operating cost estimates.

In less-industrialized countries, adequate environmental regulatory systems are often not in place or up to par with those in industrialized countries.

An excerpt from a United Nations' technical publication, describing the regulatory system for waste management in Asia illustrates this point:

> *"The most common MSWM [Municipal Solid Waste Management] problems in developing countries of the region are: institutional deficiencies, inadequate legal provisions, and resources constraints. There is considerable overlap of administrative and enforcement authorities at the national, regional, and local levels as far as environmental control is concerned. There is a lack of long- and short-term planning due to resources constraints and the shortage of experienced specialists.*
>
> *Many of the laws and regulations dealing with MSWM are outmoded and fragmented; they are inadequate to deal effectively with the complications of managing wastes in large cities. National legislation for land use and environmental control is now being formulated. In many cases, the regulations are directly copied from industrialized countries without any serious study of the social and economic conditions, the technology, the level of skill required, and the local administrative structure. As a result, they prove to be unenforceable. Often the old regulations are not cleared off the books. Lack of authority to effectively enforce existing environmental regulations is a major problem."*[35]

Without proper regulatory control, surrounding communities will be at even greater risk from air emissions from waste incinerators and water pollution from ash disposal in inadequate landfills. This, of course, begs the question of whether even highly regulated waste incinerators are safe. Real life experience with modern incinerators proves they too are a threat. For example, a US$225 million municipal solid waste incinerator, built by Olivine Corporation, in Bellingham, Washington (U.S.) had consistent difficulties meeting regulatory standards. According to the Northwest Pollution Authority records, the agency reported 37 violations by Olivine's incinerator from 1994 until the plant's forced closure in 1998.[36]

9. Incinerators produce a toxic ash that requires disposal in engineered landfills, significantly adding to costs

Most modern incineration technologies designed to reduce the emissions of air pollutants simply move the toxics to the ash. As air emissions get cleaner, the ash gets more toxic and ash is rarely handled in the strictly controlled manner it should be. (See sidebar on the Newcastle ash fiasco in the U.K.) Incinerator operators typically mix toxic fly ash from the stack with the less toxic "bottom" ash (ash left on the incinerator grate), thus enabling the ash to be labeled less toxic. Incredulously, the industry continues to promote "recycling" of incinerator ash.

Ash management poses severe environmental and economic problems. Where incinerators are planned in industrializing countries, the ash would be most likely destined for unlined dumpsites with devastating results. Ironically, if specially designed landfills were built to handle the ash, they would drastically increase the cost of incineration while only delaying the environmental impacts of the toxic ash. In the United States, a double lined landfill could cost about half a million U.S. dollars per acre and still will eventually leak.

10. Tonnage shortfalls increase financial problems

In most parts of the world, incinerator operators receive a per tonne "tip fee" for the trash they burn. They count on this tip fee and a certain annual tonnage throughput in order to pay off incinerator debts and cover operating costs. When tonnage falls below projected levels, incinerators will run into financial woes.

Flows of discarded materials vary for many reasons including economic and seasonal variations. Furthermore, incinerators are typically planned to have a life span of at least 20 years. Therefore, planners need to be relatively certain that disposal tonnages will at least remain consistent, or grow, over this long period. At first glance, this seems a reasonable assumption for most industrializing countries. After all, urban populations in industrializing countries have been growing rapidly as have per capita discards.

At second glance, these assumptions should be questioned. Any number of circumstances could cause disposal amounts to drop below projections, including economic downturns, regulatory changes, or increased waste reduction and recycling. In the event that waste flows drop below projected amounts, communities often still must pay for the incinerator (see the sidebar about Montgomery County, Maryland, U.S.). In order to finance these facilities, operators often tie communities into "put-or-pay" contracts, which require communities to pay tip fees for a guaranteed amount of waste, whether it is delivered to the facility or not.

In the 1980s, when many U.S. incinerators were built, numerous U.S. communities relied on "flow control" legislation to direct waste to their incinerators. Flow control legislation basically dictated that a community must send its waste to a particular disposal facility. In 1994, the U.S. Supreme Court declared flow control unconstitutional. This resulted in a decline of tonnage delivered to many incinerators. As a result, many incinerators were unable to repay their debt. For example, in the early 1990s, five counties in New Jersey, U.S. — Essex, Warren, Gloucester, Union and Camden — were struggling under huge debt burdens because they could not find enough trash to burn in their incinerators. The abolition of flow control contributed significantly to the waste shortfalls at these facilities. The state had loaned much of the money for the construction of these

Incinerator tonnage shortfalls cost citizens money in Montgomery County, Maryland, U.S.

The bond prospectus for this 1,600 tonne-per-day Ogden Martin incinerator expected tonnage per day for the first year to average 1,270 tonnes; costs to be US$73 per tonne; and electricity sales to be 5¢/kWh. In actuality, tonnage for the first year was more than 20% below this expectation, real costs were more than US$90 per tonne, and electricity was selling to the local utility, PEPCO, for 2.43¢/kWh. County decision-makers blamed lack of tonnage flowing to the facility as the main problem. Because communities and local haulers balked at paying high tipping fees, they stopped bringing their waste to the facility. The result of this "garbage flight" was, of course, to increase the incinerator's real per tonne costs. In order to attract more waste, tip fees were lowered July 1996 to US$40 per tonne (from a previous rate of $54) and to make up the shortfall in revenue, the County set up a "base system benefits charge" assessed to all County property owners. This charge, a line-item on the county property tax bill, was increased 55% in fiscal year 1997, from US$59.26 per property owner to $91.78. According to County documents, 78% of the base system benefits charge goes to prop up the County's waste incinerator. Property owners are now subsidizing the incinerator at least US$20 million per year. Consultants hired by the County and State badly over-estimated the amount of waste that would be available to feed the incinerator. They also under-estimated the cost-per-tonne to incinerate and the potential for recycling. The incinerator and the County's proposed source reduction and recycling programs are now competing for the same materials and financial resources. The County did not meet its 50% recycling goal by the year 2000.

Source: Brenda Platt, A Non-Incineration Alternative for Mercer County, New Jersey, U.S. (Institute for Local Self-Reliance, Washington, DC, U.S.: 1996).

facilities and has had to bail out the counties with taxpayers' money. In 1999, the state's general budget included over US$1 billion used to subsidize the ailing garbage incinerators.

In South Korea, some incinerators are operating at only 30 to 60% of their design capacity. The Nowon and Yangcheon incinerators are examples. These large-scale incinerators were built regardless of the amount of discards generated in their area. The Nowon incinerator has a capacity of 800 tonnes per day but the local generation of discards is only 353 tonnes per day (including recyclables). Seoul's administration is trying to increase the amount of materials flowing to incinerators by importing waste from other areas, but this would break a promise with residents that waste from other areas would not be brought in. With the increasing rate of recycling, especially the separate collection of food scraps, many incineration facilities are expected to record low rates of operation.[37]

Other parts of the world may face similar and even exacerbated problems. In the absence of any regulatory infrastructure requiring flow control, trash haulers will not pay higher prices to bring materials to an incinerator if cheaper options exist. The lack of public control and incentives combined with increased incineration costs will likely cause more illegal waste disposal activities. Thus, incinerators will either face tonnage shortfalls and thus revenue shortfalls, or incinerator operators will have to lower tip fees to attract tonnage. Either way, citizens and taxpayers are left paying the bill.

11. Lack of infrastructure may doom incinerators to financial failure

Inherent environmental problems not withstanding, to be financially viable, incineration necessitates a fully developed and controlled solid waste system, which includes:

- Guaranteed supplies of waste in terms of quantity and quality for the lifespan of the facility;
- A system for ensuring payment of solid waste charges;
- Authorities responsible for control and enforcement;
- A controlled landfill for disposal of incineration residue;
- Skilled workers and adequate plant management; and
- Convertible currency for purchase of spare parts.

Industrializing countries more often than not lack the necessary infrastructure and institutional arrangements to support waste incineration. For instance, incineration requires bulk collection, but studies have shown that the bulk collection equipment used in industrialized nations may not be appropriate in industrializing countries.[38] Expensive collection trucks and compactors developed and used in industrialized countries are difficult to operate and maintain, and are unsuitable for the narrow lanes, the high traffic density, and the nature of waste in industrializing countries. Furthermore, incinerators in the U.S., for example, rely on well-established waste collection systems that serve every household. In industrializing nations, much waste often goes uncollected. For example, the Solid Waste Management Department of Karachi Metropolitan Corporation (Pakistan) estimates that only 50% of the city's daily trash generation is collected from the streets by the municipal service.[39] If incinerators are sized based on total generation rates, shortfalls may occur because of low collection rates.

Incineration will almost certainly increase solid waste management costs. Household and business waste generators must be willing to pay the additional cost. If not, incinerator owners will inevitably get government, and thus taxpayers, to subsidize the facilities. If households and businesses are to be assessed all or part of solid waste costs, an adequate system for collecting payment must be in place.

12. Citizens and taxpayers pay for incinerators' financial problems

In industrialized nations, the costs of waste disposal are sometimes borne by those who generate the waste but often the costs are buried in the tax base. A disconnection exists between waste generation and collection/disposal costs, resulting in the polluter rarely having to pay the full costs. In industrializing countries, this disconnection between waste generation and waste management financing is even more pronounced. Often municipalities, or neighborhoods in large urban areas, provide collection services, using either tax revenues or user fees to cover the costs. Much waste is left uncollected, especially in poorer areas. National or regional governmental bodies often own and operate disposal facilities. Many charge a nominal tipping fee that does not reflect the true costs of disposal, or charge no tipping fee at all.

Construction of incinerators generally ties governments into long-term contracts guaranteeing delivery of waste tonnage to the facilities at a specified fee (these fees usually escalate as time passes). Full cost recovery is essential to being able to finance debt obligations. Yet incineration tip fees can seldom be set to cover full costs as waste haulers will simply take their waste elsewhere, with the net effect of encouraging illegal dumping. Thus, incinerator operators must cover costs by other means such as general waste service charges or subsidies. This typically means passing costs onto citizens and taxpayers.

13. Incinerators limit least-cost options such as waste prevention and recycling

Incinerators perpetuate the need to produce waste. They prevent implementation of less costly and less polluting alternatives. They need a minimum amount of garbage daily to operate properly and generate electricity. Because of their voracious need for discards for fuel, incinerators lock up the waste stream. They encourage increased product consumption and waste generation. They discourage efforts to design waste out of the system, to promote waste prevention and to develop sustainable methods of production and consumption.

Materials commonly burned in incinerators such as paper, garden discards, and some plastics have a much higher value when used as raw materials than when used as fuel.

Furthermore, materials commonly burned in incinerators, such as paper, garden discards, and some plastics have a much higher value when used as raw materials than when used as fuel. Reuse, recycling, and composting also provide opportunities for economic development and job creation that are precluded by incineration.

If waste prevention and recycling programs successfully reduce waste below the amount needed by an incinerator, local authorities can find themselves paying for the incineration of waste that does not exist or be tempted to import waste. A more likely scenario is the incinerator hampering waste reduction efforts, because it needs to burn materials to make good on its debt payments. Futhermore, these behemoths soak up so much of a solid waste budget that usually little money is left for comprehensive recycling and composting programs. For example, the Polish National Fund for Environmental Protection (NFOSiGW) provided a loan to build a municipal solid waste incinerator in Warsaw on the condition that the Warsaw authorities continue to finance separate waste collection and recycling. However, right after they obtained the loan, the Warsaw City Council violated the agreement and cut finances for its recycling program.[40]

Caguas, Puerto Rico, where a gasification plant is planned, is another case in point. A local environmental group met with the mayor and asked if he could still recycle if the plant was constructed.

His answer was enlightening: "You know that the contract says that for next 25 years I will have to put all my garbage into that machine."[41]

14. Incineration eliminates the potential for recycling-based economic development

By locking up the discard stream, incinerators hamper reuse, recycling, and composting activities and the benefits these waste reduction strategies bring to local economies. Reuse, recycling, and composting create many more jobs than landfilling and incineration. Table 7 compares the jobs created on a per-tonne basis for facilities in the U.S. For example, just sorting recyclables sustains approximately 11 times more jobs than incineration. In the global South, reuse, recycling, and composting can be expected to be even more labor-intensive.

In many less-industrialized countries, the informal recycling sector consisting of wastepickers and scavengers is a major player in handling discarded wastes. A 1988 report estimated that up to 2% of the population in Third World countries survives by recovering materials from waste.[42] Estimates of the proportion of the discard stream diverted range from about 2% in Metropolitan Manila, Philippines, to the residents of Mokattam, Cairo, Egypt, who recycle 80-90% of the discarded material they collect.[43] In and around Manila, approximately 40,000 to 50,000 individuals work as scavengers. The dangerous nature of this lifestyle and work was tragically illustrated on July 10, 2000, when hundreds of people died at the Payatas dump site. Rain loosened a hill of solid waste, which collapsed on top of shanties.

Incinerators put the livelihood of scavengers at risk. Communities that pursue incineration lose the opportunity to move scavengers from their dangerous, poverty-stricken lifestyles into safe, secure, and long-term employment.

Table 7: Job creation in the U.S. from reuse and recycling versus disposal

Type of Operation	Jobs per 10,000 TPY
Product Reuse	
Computer Reuse	233
Textile Reclamation	93
Misc. Durables Reuse	69
Wooden Pallet Repair	31
Recycling-based Manufacturers	
Paper Mills	19
Glass Product Manufacturers	29
Plastic Product Manufacturers	102
Conventional Materials Recovery Facilities	**11**
Composting	**4**
Landfill and Incineration	**1**

TPY = tonnes per year
Note: Figures are based on interviews with selected facilities around the U.S.
Source: Brenda Platt and Neil Seldman, *Wasting and Recycling in the United States 2000* (GrassRoots Recycling Network, Athens, Georgia, U.S.: 2000), p. 27.

15. Incineration consultants and "experts" can add millions to the costs

Incinerator projects inevitably require consultants, "experts," and lawyers, the vast majority of whom are foreign to the global South. These firms typically cost millions of dollars and the monies used to pay them often represent public money. In Puerto Rico, a small island in the Caribbean, two proposed incinerators were stopped but not before US$20 million was spent evaluating the proposals. Westinghouse was the vendor for one incinerator, a 1,040 tonne-per-day facility. The other vendor was NORECORP (using Montenay's technology) for a 1,600 tonne-per-day plant. About 90% of the money sunk into the two projects was used to pay consultants and lawyers, and about two-thirds of the monies lost were public money.[44] These two proposed plants are only two of the numerous proposals to build incinerators on the island. With the amount of money paid to consultants in the last decade, recycling activists in Puerto Rico believe the island could have built all the infrastructure needed to handle the organic fraction of its waste, a step they believe is the island's top solid waste management priority.[45]

16. Incineration's high investment costs increase potential for corruption

According to the OECD, "In most developing countries today, corruption is widespread and part of everyday life." [46] In fact, many large development projects, such as incinerator construction, in industrializing nations have been subject to rife corruption (see the sidebar on the Philippines). This practice was acknowledged by tax law in many industrialized nations. For example, tax law in Denmark, Iceland, Norway and Sweden, used to allow companies to deduct bribes paid to foreign public officials if they were documented business expenses and if they were a customary practice in the country of the recipient.[47] Obviously, this practice increases project costs, while delivering no benefit to anyone other than the graft recipient.

In Puerto Rico, tens of millions of dollars in public funds have been lost to corruption on contracts related to "waste management." After a decade of public outcry by the environmental movement, a Blue Ribbon Committee is investigating this corruption.[48]

Corruption and solid waste management in the Philippines

Patronage, corruption, and the use of political connections have long been part of waste management in the Philippines, at both the local and national levels.

Former Metro Manila Administration Commissioner for Operations Edgardo Cayton charges that public officials routinely receive kickbacks in exchange for having awarded waste management contracts. According to Cayton, the kickbacks can range from 10 to 40 percent of the contract's value.

Others have alleged irregularities and corruption by and aimed at public officials. For example, Carmona Vice Mayor Eloisa Tolentino recalled that when she was a city councilor and the leader of a local movement trying to block the construction and operation of the landfill there, a member of the now defunct Metropolitan Manila Authority offered her P150,000 (~US$2,800) a month for 10 months "just to shut up."

Wastepickers retrieve recyclable resources in a dumpsite in Metro Manila, the Philippines. © G.Cruz/Greenpeace

A recent case at the national level involves the granting of a 25-year landfill contract worth US$1.1 million a month, or a total of US$330 million for the entire period covered by the deal, to the Pro-Environment Consortium (PEC) on September 28, 1999. The terms of reference for the contract were written by the Greater Metro Manila Solid Waste Management Committee, created in 1999 by former Philippines President Joseph Estrada.

One of the four main investors in PEC is the Environmental Dynamics Corporation (EDC), a company with close ties to Estrada. Incorporators of EDC allegedly include a former classmate of Estrada and a cousin of one of his mistresses.

A waste management company official who wishes to remain anonymous alleges PEC executives knew details of the bidding process and contract requirements at least a year in advance of its public release.

Source: Marites N. Sison, "Firm Linked to Estrada Got Metro Manila Garbage Contract," Philippine Center for Investigative Journalism, January 24-25,2001, available at <http://www.pcij.org/stories/2001/garbage.html>.

Another form of corruption is buying the "goodwill" of environmentalists either through awarding funds to environmental organizations or directly to individuals. In Puerto Rico, the environmental organization, Mision Industrial de Puerto Rico, has repeatedly been offered bribes to embrace waste incineration. The group declined and denounced the offer in the media.[49]

17. Incineration has high public health costs

Some of the greatest costs of incineration are often ignored by traditional economic analysis. These are the external environmental and public health costs resulting from air and water pollution.

The pollution from incinerators causes adverse health effects in workers at the facilities, and populations living both near and far. Furthermore, this pollution can also harm exposed flora and fauna.

All incinerators release pollutants to the biosphere through air and ash emissions. While the exact composition of these emissions can vary according to the composition of waste burned and the completeness of combustion, typical incinerator emissions include acid gases, particulate matter, carbon monoxide, nitrogen oxides, metals, dioxins and furans, other persistent organic pollutants (POPs such as hexachlorobenzene and polychlorinated naphthalenes), and at least 190 volatile organic compounds.[50] (In this chemistry context, "organic" refers to carbon compounds.) Many of these chemicals are known to be persistent, bioaccumulative, and toxic. These pollutants cause a wide variety of adverse health effects including cancer, respiratory disease, and disruption of the endocrine system.[51]

Reported health impacts on workers at incinerators include chloracne, hyperlipidemia (elevation of lipids, such as cholesterol, cholesterol esters, phospholipids and triglycerides (fats) in the bloodstream), allergies, and hypertension. Some studies have also identified links between working at an incinerator and increased risk of death from heart disease, lung cancer, esophageal cancer, and gastric cancer.[52]

Numerous studies have reported increased incidence of cancers, respiratory ailments, and congenital birth defects among residents residing near incinerators. Other studies indicate that distant populations can be exposed to pollution from incinerators by ingesting contaminated plant or animal products.[53]

The costs to society of these adverse health effects are rarely included in economic analyses, and are indeed difficult to quantify, but should not be ignored.

18. Incineration wastes resources and energy and associated investment

Incinerator proponents tout the benefits of converting "waste to energy." In reality, these facilities are a waste of energy. The small amount of energy incinerators do produce does not come near the amount of energy that could be saved by recycling and resource conservation.

How much energy do incinerators produce? If the United States burned all its municipal waste it would contribute less than 1% of the country's energy needs.[54] This figure does not take into account the massive energy investment of building, operating, maintaining, and dismantling the facilities themselves. Recycling saves energy by reducing the need for virgin resources. The collection, processing, and transportation of materials for recycling typically uses less energy than the steps in supplying virgin materials to industry (including extraction, refinement, transportation and processing). Even more energy savings accrue in manufacturing processes. On the whole, three to five times more energy can be saved by recycling materials than by burning them.[55]

For every tonne of material burned by incineration and rendered unusable by landfilling, many more tonnes of raw materials must be mined, extracted,

processed, or distributed to manufacture new products to take its place. More trees must be cut down to make paper. More ore must be mined for metal production. More petroleum must be processed into plastics. The environmental costs of landfilling and incineration become magnified when the environmental costs of extracting virgin materials and producing goods in the first place are taken into account.

Incineration encourages a one-way flow of materials on a finite planet. It makes the task of conserving resources and reducing waste more difficult, not easier.

19. Incinerators lower property values

Waste incinerators can lower property values. The truck traffic, blowing trash, birds and rats attracted to trash, noise, odor, and pollution caused by incinerators can all contribute to a drop in property values. The effect of incinerators on property values is not consistent nor predictable. In one review of ten studies that examined the impact of landfills and incinerators on property values, the authors found that half of the studies concluded there was a significant decline in property values.[56]

20. Incineration encourages continued waste generation and reinforces the notion that unwanted discards are a local community responsibility and cost

Incinerators need discards to operate and make good on debt payments. If local communities cannot provide sufficient quantities of discards, then incinerator operators may import material from elsewhere to feed the incinerator. Reliance on incineration perpetuates the throw-away lifestyle, continued production of products and packaging without thought to their reusability or recyclability, and local government and taxpayers taking full responsibility for unwanted discards and the costs of managing these. Manufacturers have the ability to redesign their products and packaging to reduce toxics, conserve resources and ensure that they are reusable, recyclable, or compostable. Incineration takes away the incentive and pressure for corporations to move in this direction. Thus, incineration reinforces the notion that unwanted discards are a local community financial responsibility. Corporations can produce toxic wasteful products without any financial responsibility for their end of life. Local government and taxpayers pay the bill for collecting and handling products and packaging once discarded. Incineration encourages waste generation and discourages waste prevention and clean production. Incineration needlessly locks local communities into ever-increasing solid waste collection and management costs. Communities that build incinerators end up subsidizing an obsolete expensive technology while hampering new systems that can lower costs in the short and long term.

On the whole, three to five times more energy can be saved by recycling materials than by burning them.

How to evaluate a planned incinerator

Incineration is not an appropriate method for discard management. Yet, incineration proposals are currently pending worldwide. Even presented with viable alternatives, many local officials will continue to back incineration. The following is a checklist of issues for concerned citizens and decision-makers to raise during public debates and to highlight in press materials. If any answer given by project proponents differs from those presented, the issue can be used as leverage against proposed incinerators. Even in the unlikely event that an incinerator proponent can provide answers which match those below, GAIA would still oppose the incinerator for all the reasons outlined in this report. These questions are nonetheless useful in exposing the flaws in an incinerator proposal.

QUESTION	ANSWER
Consideration of alternatives	
Have incineration alternatives been fully considered?	Yes
Are organic materials being collected for composting or anaerobic digestion?	Yes
Have waste prevention, reuse, recycling, and composting programs been implemented? These programs must include conventional recycling as well as toxics use reduction, extended producer responsibility and other "upstream" approaches to reducing both the volume and toxicity of the materials used in production, packaging and products.	Yes
Safety issues	
Does the proposed facility incorporate state-of-the-art pollution control devices (i.e. lime scrubbers, activated carbon injection systems, bag filters, and rapid quench spray dryers)?	Yes
Are adequate regulatory standards and enforcement programs in place to attempt to ensure safety?	Yes
Will the plant be sited in an area already burdened by poor air quality?	No
Will working conditions of staff ensure their health and safety?	Yes
Does an adequate system exist to remove hazardous materials from the waste stream before incineration?	Yes
Does the ash management plan require special handling of the ash including, at a minimum, disposal in a lined landfill with leachate collection systems?	Yes
Financial issues	
Do reported operating costs include testing and compliance costs?	Yes
Are international public lenders involved in the financing scheme for the proposal?	No
Will loan amounts become a sovereign debt of the nation if the project fails?	No
Will the project receive direct or indirect government subsidies?	No
Does the local waste management agency generate sufficient revenue year after year to cover annual debt service and operating costs?	Yes
Does the incinerator owner and/or operator have sufficient access to foreign currency in order to purchase needed parts for plant maintenance and repair?	Yes
Have the population and commercial sectors been surveyed to assess their willingness and ability to pay waste service charges [or subsidies] needed to finance and operate facility?	Yes
Do markets for generated heat or electricity exist that can purchase the energy without subsidies?	Yes

Waste stream	
Has the waste stream been fully characterized and demonstrated to have sufficient Btu value to sustain incineration even after all recyclables and compostables have been removed?	Yes
Are landfill wastepickers likely to shift their operations to the beginning of the waste chain? If so, will this impact waste composition?	No
Is the collected local waste stream sufficient to meet the tonnage needs for the incinerator after maximized recycling and composting programs reduce it	Yes
Does the waste stream include any PVC or other chlorine-containing materials?	No
Infrastructure	
Is there infrastructure sufficiently developed to ensure a reliable flow of waste to the incinerator for its lifespan?	Yes
Are there ways to enforce payment of waste service charges?	Yes
Are there adequate authorities responsible for control and enforcement?	Yes
Will management of the plant be adequate?	Yes
Can waste collectors deliver collected material to other sites at a lower tipping fee?	No
Is an adequate distribution system for generated heat or electricity in place? Is a connection to the system located less than 3 kilometers from the proposed site?	Yes
Is a sufficient water supply available to meet the burner's and pollution control equipment's operating requirements?	Yes
Will the transportation infrastructure support the traffic created in the vicinity of the plant?	Yes
Social issues	
Will numerous scavengers lose their livelihood if waste is diverted to an incinerator?	No
Will the plant be located in or near residential areas?	No
Are trained, qualified staff available?	Yes
Proposed technology	
Is the proposed facility based on experimental technology such as fluidized bed combustion, gasification, or pyrolysis?	No
Does the proposed facility include at least two or more units to ensure continuous operation while one unit is being serviced?	Yes

Note: Some of the questions above were adapted from T. Rand, J. Haukohl, U. Marxen, *Municipal Solid Waste Incineration: Requirements for a Successful Project*, World Bank Technical Paper Number 462, The World Bank, Washington, D.C., U.S., June 2000.

Source: Institute for Local Self-Reliance, Washington, DC, U.S., 2004

INCINERATOR myths

Incinerator proponents buy into a number of myths when trying to sell projects. Here are some common myths surrounding municipal solid waste incineration:

Myth: Incinerators provide a solution to the problem of rapidly increasing waste.

Reality: Incinerators do not make municipal solid waste magically disappear. Indeed, they encourage waste generation and current patterns of production and consumption, which are at the root of solid waste problems. Incinerators are the most costly of all solid waste management options, result in air and water pollution, and still need to be supplemented by landfills as they produce an ash that is far more toxic than ordinary domestic trash.

Myth: Incinerators maximize the use of scarce landfill space.

Reality: Communities with incinerators still need landfills for ash disposal and by-pass wastes. Ash can comprise about 25% by weight of an incinerator's throughput and must be landfilled. Thus, incineration means incineration plus landfill. There are two kinds of by-pass waste: bulky materials that do not fit into the incinerator (such as mattresses), and collected waste that cannot be burned when the incinerator is down for regularly scheduled or unscheduled maintenance. These materials typically require landfilling in communities that have built incinerators. On the other hand, embracing zero waste as a planning tool and a vision for the future will extend landfill life and help build a sustainable system to avoid waste and recover materials.

Myth: Incineration is less expensive than other options, including recycling and "sanitary" landfills and incineration yields electricity, a useful by-product.

Reality: Incineration is the most costly of all waste management options. Costs cannot be offset with energy revenues. Consider Rhode Island's (U.S.) 1992 law that banned municipal solid waste incineration in the state: "…incineration of solid waste is the most costly method of waste disposal with known and unknown escalating costs which would place substantial and unreasonable burdens on both state and municipal budgets to the point of jeopardizing the public's interest." In general, incineration costs 5 to 10 times more per ton than sanitary landfills, even after discounting energy revenues. If incineration is cost-competitive with landfilling, recycling, or other options, residents of the global South should be concerned that such "cheap" incinerators do not have the pollution control equipment that their counterparts in countries with more stringent regulations might have. With regard to energy, considerably more energy can be saved through alternative strategies such as waste prevention, reuse, recycling, and composting than can be generated by burning. Three to five times more energy can be saved by recycling than by burning materials.

Myth: Local communities prefer incinerators to landfills.

Reality: Incinerators, like landfills, are highly unpopular among local communities. Knowledgeable community activists the world over have fought to prevent construction of incinerators. Hundreds of projects have been cancelled or put on hold as a result of citizen opposition. In the U.S., Philadelphia, Seattle, Portland, Austin, San Diego, Boston and other cities have cancelled proposed municipal waste incinerators. In the Netherlands, citizens organized to defeat a US$700-million incinerator proposed for a suburb of The Hague, then organized a national network against all proposed and operating incinerators in the country. In Germany, some 500 grassroots groups oppose incineration. As public opposition to the construction of new incinerators in the west continues to grow, western incineration industries are pushing their unwanted technology east.

Myth: Incinerators are safe and more environmentally benign than landfills.

Reality: Incinerators increase risk of environmental and health threats as compared to other waste management alternatives. In addition to the threat to groundwater from ash disposal, incineration creates large amounts of air pollution. Incinerators are major – and in many areas the largest – sources of pollutants such as dioxin, lead, and other heavy metals released into the environment. They also release carbon monoxide, oxides of sulfur and nitrogen, hydrocarbons, and particulates into the air.

Source: Institute for Local Self-Reliance, Washington, D.C., U.S., 2004.

Incineration alternatives and zero waste planning

Alternatives to incineration exist and are economically viable. Numerous jurisdictions have rejected incineration in favor of programs that prevent, reuse, recycle, and compost discarded materials. In the global South, where organic material—yard trimmings and food scraps—is the single largest component of the waste stream, appropriately designed composting programs will be the easiest, quickest, and least-expensive method to divert discards from disposal. The growing worldwide movement toward clean production and product design is supporting waste reduction strategies, further eliminating the pressure for disposal options such as incineration.

A variety of systems for diverting materials from disposal have been implemented worldwide. Table 8 lists jurisdictions around the globe that have achieved high diversion levels through reuse, recycling, and composting (where diversion level represents the portion of waste generated diverted from landfill or incineration disposal). The heart of most of these programs is door-to-door or curbside collection of segregated materials for recycling and composting.

To be effective, waste reduction programs, like all discard management systems, must be based on appropriate technical solutions and be designed with local conditions and needs in mind. Most industrializing countries have limited experience with operating and maintaining centralized discard handling systems. Thus, it is no surprise that successful waste diversion programs in the global South tend to have decentralized collection and sorting systems. The informal sector (wastepickers and scavengers) along with community initiatives often represent the backbone of recovery activities. Integrating the informal sector and community initiatives into citywide solid waste management planning is not only possible but a key to success. These decentralized activities may need only an institutional structure and land for activities such as composting to be scaleable to city levels. Indeed, community projects can become mainstream solutions by being replicated in neighborhood after neighborhood.

High waste prevention and diversion levels are possible and cost-effective.

This section on non-incineration alternatives identifies some model discard management programs; summarizes the growing zero waste movement; discusses recycling and composting options, public outreach programs, and policy initiatives that support disposal reduction; and highlights the unique and important role of the informal sector in recovery activities. It also presents ten steps to get started on the path toward zero waste.

GAIA recognizes that recovering valuable materials from the discard stream—as in many working examples described in this report—is essential for communities to move towards the goal of zero waste. However, recovery alone isn't enough; recycling and composting programs must be coupled with programs to reduce the volume and toxicity of waste at source to maximize the success

of recovery programs and to move even closer to zero waste.

High waste diversion levels are possible and economical

Proponents of large disposal facilities often argue that the facilities are necessary because waste prevention, reduction, composting, and recycling cannot substantially reduce disposal needs and are too expensive. This is wrong on both counts.

As Table 8 indicates, numerous jurisdictions throughout the world have achieved 40% and higher diversion levels for municipal discards. Waste reduction record-setters include communities in industrializing countries:

- Informal garbage collecting enterprises collect one-third of Cairo's household discards – 988,400 tonnes per year – and recycle 80% to 90% of what they collect (see Table 9).
- Curitiba, Brazil, recycles two-thirds of its garbage.
- A neighborhood participating in the Advanced Locality Management program in Andheri, Mumbai (formerly Bombay), India, reduced its garbage disposal by half within two years.[57]
- A community-based organization, Exnora International, in India, has developed a decentralized recycling/composting approach that has the potential to divert 90% of municipal discards. It has been implemented successfully in many Indian communities.

Table 8:
Communities with high waste diversion levels

Locale	Diversion Rate[1]
Zabbaleen-served areas of Cairo, Egypt	80-90%
Opotiki District, New Zealand	85%
Gazzo (Padua), Italy	81%
Trenton, Ontario, Canada	75%
Bellusco (Milan), Italy	73%
Northumberland County, Ontario, Canada	69%
Sidney, Ontario, Canada	69%
East Prince, Prince Edward Island, Canada	66%
Boothbay, ME, U.S.	66%
Halifax, Canada	65%
Chatham, NJ, U.S.	65%
Falls Church, VA, U.S.	65%
Curitiba, Brazil	65%
Galway, Ireland	63%
Belleville, Ontario, Canada	63%
Canberra, Australia	61%
Bellevue, WA, U.S.	60%
Sun Valley, the Philippines	59%
Guelph, Ontario, Canada	58%
Gisborne District, New Zealand	57%
Clifton, NJ, U.S.	56%
Loveland, CO, U.S.	56%
Alameda Co., CA, U.S.	55%
Bergen Co., NJ, U.S.	54%
Worcester, MA, U.S.	54%
Leverett, MA, U.S.	53%
Ann Arbor, MI, U.S.	52%
Crockett, TX, U.S.	52%
Dover, NH, U.S.	52%
Kaikoura District, New Zealand	52%
Barangay Bagumbuhay, the Philippines	52%
Switzerland	50%
Nova Scotia, Canada	50%
Andheri, Mumbai, India	50%
Fitchburg, WI, U.S.	50%
Madison, WI, U.S.	50%
Portland, OR, U.S.	50%
Visalia, CA, U.S.	50%
Seattle, WA, U.S.	44%

[1]Diversion levels are not comparable from one community to another as some may reflect only recovery of residential waste and others may apply to the total municipal solid waste stream. The data are also not for the same year. In addition, different methodologies were used to calculate rates from different sources.

Sources:
Institute for Local Self-Reliance, *Cutting the Waste Stream in Half: Community Record-Setters Show How*, United States Environmental Protection Agency. EPA-530-F-99-017 October 1999.
Neil Tangri, Global Anti-Incinerator Alliance/Global Alliance for Incinerator Alternatives, *Waste Incineration: A Dying Technology*, Washington, D.C., U.S., 2003.
Creating Wealth From Waste, Robin Murray, Demos, UK, 1999, pp. 33-34.
A Citizen's Agenda for Zero Waste, Paul Connett and Bill Sheehan, G&G Video, Grassroots Recycling Network, Athens, Georgia, U.S., October 2001, p. 19.
BioCycle, Vol. 40 No. 3, March 1999.
Institute for Local Self-Reliance, *Innovation, Leadership, Stewardship* (Washington, D.C., U.S.: Institute for Local Self-Reliance, 2002).
"County recycling rate is best in nation," *The Independent,* March 7, 2001.

- A small barangay[58] in the Philippines (Barangay Bagumbuhay) is diverting 52% of household discards from disposal. (See pages 42-43.)

- Another Philippine barangay, Sun Valley, is diverting 59% of household discards through segregated collection of organics and recyclables. (See the sidebar on page 53 .)

Costs of these systems vary widely according to many factors, including technologies and strategies used, market values for materials collected, and fuel and labor costs.

Table 9: Materials recovered by Mokattam recyclers, Cairo, Egypt

Type	Tonnes per week	%*
Iron	1.2	0.05
Nylon bags	3.3	0.13
Copper	3	0.13
Soft plastic	6.6	0.3
Animal bones	6.6	0.3
Aluminum	8.8	0.4
Transparent plastics	16.5	0.7
Cloth	23	1.0
Broken glass	27	1.1
Paper	36	1.5
Tin	95	3.9
Cardboard	99	4.1
Nakdah[1]	477	20.0
Organic waste	478	20.0
Whole glass	753	31.3
Recovered	***2,034***	***84.7***
Rubbish[2]	366	15.3
Total	***2,400***	***100***

Note: Mokattam is one of five neighborhoods surrounding Cairo that collects discards from Cairo.
* Figures were rounded off to the nearest tenths and hundredths.

[1]Miscellaneous items such as toys, vases, artificial flowers.
[2]Residual waste which is transported to a municipal dump.

Source: *The Informal Solid Waste Sector in Egypt: Prospects for Formalization* (Cairo: Community and Institutional Development, January 2001), p. 20.

Well-planned waste prevention and diversion programs are usually no more expensive than disposal, and are often cheaper. Per household costs for residential waste management in Seattle, U.S., (including composting, recycling, and disposal) were nearly identical in 1987, when residents diverted 19% of their waste from disposal, and 1996, when they diverted 49% from disposal. The recycling program in Curitiba, Brazil, costs no more than it did to bury waste in the city's old landfill. The recyclers of Mokattam reduce waste at no cost to the municipal government. Their activities are driven by market forces – they collect and recover materials from the discard stream because the materials have value.

In the global South, recycling and composting program costs are orders of magnitude cheaper than incineration costs. In industrializing nations of the global South, recycling and composting programs incur minimal capital investments. They rely on labor not mechanical equipment for collection, sorting, and composting. Programs tend to be more decentralized and small scale as compared to their counterparts in the north. Pedicabs can replace trucks as collection vehicles because collection workers deliver materials to neighborhood warehouses, "eco-sheds," or recycling/composting centers that each serve only a few hundred homes. Composting does not need to be centralized, because it can take place in drums and bins at the neighborhood level.

Collecting segregated recyclables and organics for composting

Mixed together, discards are garbage. Source separated, many materials become resources. Source-separation of materials is critical to maximizing material recovery and retaining the integrity and quality of materials. Door-to-door or curbside collection of segregated materials makes participation convenient. Collectors go to each household or business to pick up discarded materials. If residents and businesses have to drop off their discarded materials at a central location, they are less likely to participate. Drop-off

The zero waste movement

In the early 1980s a small group of recycling experts started talking about the idea of "Total Recycling." Zero waste concepts followed. By 1990, activists in the Philippines were already using the term zero waste. One of the first formal zero waste policies was created in 1995 when Canberra, Australia endorsed a goal of "No Waste by 2010." Since 1995, zero waste has been endorsed as a goal by governments in New Zealand; Denmark; Seattle, Washington; Del Norte County, California; San Francisco, California; Santa Cruz County, California; Edmonton, Alberta; Ottawa, Ontario; and Nova Scotia. Furthermore, a number of national and international businesses have adopted some zero waste principles.

According to the U.S.-based GrassRoots Recycling Network:

> " Zero waste is a philosophy and a design principle for the 21st Century. It includes 'recycling' but goes beyond recycling by taking a 'whole system' approach to the vast flow of resources and waste through human society. Zero waste maximizes recycling, minimizes waste, reduces consumption and ensures that products are made to be resued, repaired or recycled back into nature or marketplace."

On a practical level, zero waste is a system that:

- redesigns the current, one-way industrial system into a circular system modeled on nature's successful strategies
- challenges badly designed business systems that "use too many resources to make too few people more productive" and which rely on toxic materials
- addresses, through job creation and civic participation, increasing wastage of human resources and erosion of democracy
- helps communities achieve a local economy that operates efficiently, sustains good jobs, and provides a measure of self-sufficiency, and
- aims to eliminate rather than manage waste.

Sources:

Warren Snow and Julie Dickinson, "The End of Waste: Zero Waste by 2020: A Vision for New Zealand," Zero Waste New Zealand Trust, Auckland, New Zealand, 2001, available at <http://www.zerowaste.co.nz/assets/Reports/TheEndofWaste.pdf>.

Gary Liss, "What Is Zero Waste?" 2000, available at <http://www.grrn.org/zerowaste/articles/whatiszw.html>, site visited August 14, 2001.

Grassroots Recycling Network, "What Is Zero Waste?" available at <http://www.grrn.org/zerowaste/index.html>, site visited August 14, 2001.

programs, however, can augment door-to-door/ curbside collection programs. They can serve as the primary method of collection in rural communities where residents self-haul trash. And drop-off systems can also serve multi-family households who may not have "curbside" service. Furthermore, drop-off facilities can sometimes accept a wider variety of materials than are collected at the curb and can provide a central location for displaying items available for reuse.

For discarded organics (yard trimmings and food scraps), an alternative to curbside and drop-off collection is backyard composting. Food scraps can even be composted inside the kitchen using worms or in containers on a porch.

In industrializing countries, labor is less expensive relative to capital than in the industrialized countries. Therefore, small trucks, hand-pulled or animal-drawn carts, and cycle carts, rather than full-scale collection trucks, mechanized compactor vehicles, and street sweepers, may be appropriate for discard collection programs. These may need to be supplemented with larger trucks in large metropolitan areas.

The New Zealand zero waste movement

New Zealand is the first country to embrace the goal of zero waste at a national level. The Zero Waste New Zealand Trust has been leading the zero waste movement in New Zealand. The Trust's mission is to "encourage and motivate all sectors of New Zealand society to work towards a target of zero waste."

To further the goal of zero waste, the Trust researches waste reduction approaches from around the world. The Trust's Zero Waste Advisors help clients including councils, recyclers, nonprofit organizations, and businesses "achieve massive and rapid waste reduction outcomes." It has distributed over NZ$1.7 million (~US$840,000) in financial support to individuals and organizations working on waste reduction and recycling.

In 1999, the Trust offered all councils in New Zealand the opportunity to take part in a National Zero Waste Pilot Project. In order to join the project, local councils had to pass a resolution committing to a target of zero waste by 2015. The Trust committed to support communities in the Pilot Project through direct financial support of up to NZ$20,000 (~US$9,900), assistance in obtaining additional financial support from other sources, and provision of technical support and advice.

The Pilot Project was originally limited to ten Councils but was eventually expanded to include 25 Councils. The Ministry for the Environment's Sustainable Management Fund provided additional funding to expand the program. As of December 2003, 39 of New Zealand's 74 local authorities have set targets of zero waste to landfill by between 2015 and 2020.

In June 2001, New Zealand's Minister for the Environment listed "implementing a new strategy to move New Zealand towards zero waste" as one of her government's highest priority issues.

Source: Zero Waste New Zealand Trust web site http://www.zerowaste.co.nz, visited December 2003; and Warren Snow, Zero Waste New Zealand Trust, New Zealand, personal communication, June 25, 2001.

A "recycling wall" at Kataia, New Zealand operated by the Community Busines Environment Centre (CBEC). © Envision New Zealand

The methods of source-separation are as diverse as the people and places where they have been implemented. Communities around the globe have implemented systems requiring residents to sort materials into two to ten fractions. The most basic system is a wet/dry sort, in which wet organic materials (garden waste, food discards, soiled paper) are placed in one container and dry materials (clean paper products, bottles, cans, and other containers) in another. Wet/dry systems have been very successful in reducing disposal. See the examples below and the sidebars on Curitiba, Brazil (page 36), Exnora International, India (pages 47-51), and on the Philippines' Barangay Bagumbuhay (pages 42-43), Teoville (page 52), and Sun Valley (page 53).

- The Canal Walk shopping center in Cape Town, South Africa, is Africa's largest shopping center with over 460 shops and 45 restaurants. The center's tenants implemented a wet/dry source-separation system and have reduced disposal to about 170 kilograms per day. Furthermore, the center saved R594,000 (~US$65,100) in capital costs by downscaling the number and size of trash compactors, saves approximately R20,000 (~US$2,200) every month in reduced disposal costs, and has created 28 jobs in its "In-house Waste Collection/Separation" service.[59]

- The Linis Ganda (Clean and Beautiful) program in San Juan, Manila, the Philippines, achieves source-separation of recyclables without disrupting local systems. Linis Ganda deploys "eco-aides" who go around the city with carts buying recyclable items from households. Participant households and schools separate their discards into wet and dry. The eco-aides purchase their recyclables. Approximately 500 material brokers, employing 1,000 eco-aides take part in this program.

- In Pune, India, the municipal government granted adult wastepickers (scavenger and itinerant buyers) the authority to collect recyclable scrap by endorsing photo-identification membership cards for a newly formed wastepicker collective. The local government further promoted public awareness of a new discards segregation system in which the wastepickers collect, at curbside, segregated organic and recyclable materials. Households pay a mandatory fee to the wastepickers in return for this service. This program has benefited everyone involved.[60]

- In New Delhi, India, wastepickers and waste dealers have formed a network with the nongovernmental organization Chintan to press for their right to safe work. Initiatives include Chintan and the New Delhi Municipal Corporation issuing photo identification cards and "healthcards." These official documents will secure access to municipal discards and enable wastepickers and dealers to negotiate with the police, municipal workers, and others who otherwise consider wastepickers and their work "dirty." Chintan is also working to strengthen the wastepickers' formal organization and improve their handling and recycling of discards. As a result, recyclers have been able to contract with both government and private agencies. These contracts are serving as models for others.

Mixed together discards are garbage. Source separated materials become resources.

To maximize material recovery, collection programs ought to be as convenient as trash collection. Economic incentives can also encourage recovery. Generally, if garbage is collected at curbside, higher waste reduction levels can be achieved if recycling and composting programs are offered at curbside too. Drop-off programs for recyclables can accept materials not taken at curbside. Many residents will respond to economic incentives and take material to a drop-off in return for compensation. For example, municipal redemption/purchasing centers in Shanghai, China, pay for recyclable items. In the Klong Toey (Bangkok, Thailand) Environmental Protection Group's "Garbage for Eggs" project, residents of the Klong Toey slum are given the opportunity to trade source-separated recyclables for eggs. By the second half of 1999, more than 10,000 people from 15 different communities were participating in the project.

When designing collection programs, care should be given to integrating wastepickers into the scheme. Otherwise, they risk losing their livelihoods[62] and municipal waste planners risk losing the experience and expertise of the wastepicker communities. Privatizing trash collection, in particular, can displace wastepickers. In one area of Pune, India, contractors were hired to collect and dump unsegregated waste. Twenty wastepickers were displaced as they were denied access to scrap.[63] A similar case took place in Chennai, India (formerly Madras), when the company Onyx was awarded a contract to collect and transport mixed waste in three municipal zones where previously the nonprofit group, Exnora was working. Overnight, waste bins appeared where there had been none, and ragpickers were denied access to the discarded material. In addition, when Onyx had a labor strike for four days in October 2001, waste spewed onto the street as both the community effort and the municipal activities had been displaced.[64]

One key to successful waste diversion in the global South is to keep the programs local and the materials segregated.

These examples disprove the notion that centralizing and privatizing waste systems will solve waste problems. Many civic governments and development organizations mistakenly believe that community recycling and composting initiatives are small, local, individually run, and cannot be scaled up in size to city levels. They thus push for centralizing and privatizing waste systems. However, community initiatives can be replicated and expanded to city levels. They often need only an institutional structure that accommodates and supports them. Earmarking land for composting activities, for example, could greatly enhance community composting levels. An institutional framework is needed that allows for decentralized functioning and local community initiatives. One key to successful waste diversion in the global South is to keep the programs local and the materials segregated. If this is not done, only large privatized systems may work and they then become a fait accompli.

Recyclables processing

Usually even source-separated recyclables require some processing before being ready for markets. Normally materials need to be sorted and readied for transport to markets. Sorting systems can range in complexity from hand-sorting from large piles, sorters pulling materials off conveyor lines, to highly mechanized sorting plants that employ few laborers and use rotating screens, air streams, large magnets, and other equipment to separate materials from one another. Baling materials can increase efficiency of resources used for transportation to markets.

A decentralized low-tech approach can work well in the global South. For example, in Exnora International's program, collection workers deliver and sort segregated recyclables into nine different containers at a decentralized "zero waste center." Each collection worker and center serves about 200 families. See pages 47-51 for more information.

Curitiba, Brazil recycles two-thirds of its discards

Curitiba's citizens use a two-sort system for their discards. Slightly different from a wet/dry system, residents separate their materials into recyclable and non-recyclable fractions. Poor families in squatter settlements unreachable by collection trucks bring bags to neighborhood centers, where they exchange them for bus tickets, or for eggs, milk, oranges, and potatoes bought from outlying farmers.

Collectors deliver recyclable materials to a plant, itself built of recycled materials, that employs 100 people to separate bottles, cans, plastics, and paper. The facility provides jobs to handicapped people, recent immigrants, and alcoholics.

Recovered materials are sold to local industries. Polystyrene is shredded to stuff blankets for the poor. The recycling program costs no more than the old landfill, but the city is cleaner, there are more jobs, farmers are supported, and the poor get food and transportation. Curitiba recycles two-thirds of its garbage, one of the highest rates of any city, North or South.

Source: Donella Meadows, "The Best City In the World? Making a solid case for better urban planning," In Context, Number 39, Fall 1994, available at <http://www.context.org/ICLIB/IC39/Meadows.htm>.

The recyclers of Mokattam, Cairo, Egypt

Egyptians have a long-standing tradition of recovery, trade, and recycling of non-organic discards. This practice is prevalent all over the country and has led to the creation of trading networks for recovered materials. It has also spawned specialized towns, which have become centers of micro-enterprise recycling industries. Five neighborhoods on the outskirts of Cairo collect, sort, and/or recycle one-third of Cairo's trash (pop. 15 million). Local municipalities, organized by the Cairo Cleaning and Beautification Authority, collect another third. The rest sits uncollected on the streets of Cairo. The residents of the five neighborhoods, referred to as "zabbaleen," recover an impressive 80% of the materials they collect at no cost to the Cairo city government. In contrast, the portion handled by the government is disposed at a cost of LE 110 million per year (~US$26 million) and US$100 million for equipment needs.

Mokattam is one of the five neighborhoods. Nearly all of its almost 20,000 residents work with discarded material. Mokattam is a hub of recycling activity, generating employment and income for thousands of individuals – individuals who have become the most innovative and enterprising recyclers in Egypt. Three types of businesses thrive: (1) collectors, (2) intermediary trading enterprises, and (3) recycling workshops.

Collectors: Mokattam has 700 collecting enterprises that collect, recover, and trade discarded materials. Most provide daily collection service directly to middle-low-income and high-middle-income households in Cairo for an average monthly fee of LE 2-4 (~US$0.47-$0.94). The remaining garbage collector enterprises are roamers; they collect materials accumulated on streets or in empty lots. The garbage collectors collect about 1,490 tonnes per day or 496,400 tonnes per year.* They recover about 80% of this tonnage, which they trade, prepare as primary inputs for formal industry, or remanufacture themselves. Most garbage collectors own their own 1-or 3-tonne trucks or donkey carts. Material is dumped in the courtyard of the garbage collector and his family, where it is sorted and made ready to market. Each and every member of the family is involved. Almost 2,400 men and as many youth and children collect discarded materials while about 2,800 girls and women daily sort materials manually.** Each sorter handles an average of 0.54 tonnes per day, which she sorts into 16 different categories of material depending on type, usage, and the recovery method. Primary categories include paper, plastics, aluminum, tin, glass, batteries, cloth, animal bones, and food. The zabbaleen feed recovered food to animals they breed adjacent to their homes. Other organics are composted or transported to farmers in the Delta. The resorted and reclassified materials are sold to intermediary traders. Materials that cannot be recycled or resold are hauled to municipal dumps. Many of these could be designed out of use through changes in production processes and product design.

Intermediary trading enterprises: Mokattam has about 80 trading enterprises that sort or process materials for sale to other customers for resale or for manufacturing purposes. The enterprises employ an estimated 411 workers. Traders generally specialize in one type of material such as plastics or glass. Sorting requires space and technical expertise. On average each trader contracts with 26 suppliers who are mostly located in the settlement. On the other hand, the majority of traders have one or two customers to whom they sell their material. Their customers are recycling workshops in the settlement, large traders from outside the community, or large-scale remanufacturing plants in Egypt's industrial areas. These buyers rely on the traders' proven ability to deliver needed materials on a regular basis.

Recycling workshops: Mokattam's 228 recycling workshops employ 1,435 workers and vary in size, scope, and activities. Some specialize in a particular step of the recycling loop and have only one machine. Others have large investments and recycle certain types of materials in a multi-step process. The workshops produce final and intermediary products, which are sold to customers throughout the country.

(continued next page...)

Zabbaleen sorting out cardboards and papers in Mokattam, Egypt. © CID

The recyclers of Mokattam, Cairo, Egypt

Intermediary products may be sold to larger workshops and often to large-scale industrial plants. The total invested in the recycling workshops is LE 3,080,650 (~US$727,000), of which LE 1,805,350 (~US$426,000) is for equipment. The number of workshops in the settlement continues to grow. From 1996 to 2000, the number increased by approximately 29%.

Recycling workshops often represent self-start-up micro-entrepreneurs who use locally designed and manufactured technology available in the informal sector of Egypt's economy. For instance, one enterprise specializing in plastic food containers, cuts the containers in half, sorts them by color, washes them in boiling water and potash in a huge tub with a burning furnace underneath, dries them, and then puts the plastics through the funnel top of a plastics crusher, and finally packs the plastics in sacks for resale. Another micro-enterprise involves cloth grinding machines, which consist of two cogs moving anti-clockwise that crush the cloth into cotton stuffing for mattresses, pillows, and the like. Plastics manufacturers produce clothes hangers, pitchers, ice cream spoons, lollipop sticks, and other products. Workers perform a variety of tasks. Some of the more skilled operate heavy machinery such as injection molding machines or film molding machines in the plastics recycling workshops. The rest of the workers are unskilled laborers who perform different tasks such as sorting, loading, and preparing materials.

The Association for the Protection of the Environment (APE) has been working since the 1980s to improve the conditions of life among the zabbaleen. In 1984, APE established a composting plant in the village. This plant handles waste generated by the animals in the community. The plant has two main benefits: (1) providing an outlet through which organic material could be recycled; and (2) generating revenue from compost sales. The revenue supports an income-generating rag recycling project for girls and women, a paper recycling project for girls, a children's club, literacy classes, field trips, and health projects. More than 200 zabbaleen households bring organic material to this neighborhood composting plant. The high-grade compost is sold to agriculturists engaged in reclaiming Egypt's desert.

In 1986, another non-governmental organization, the Association for Garbage Collectors for Community Development, implemented a micro-enterprise credit scheme for recycling and transformed neighborhood garbage collectors into small-scale entrepreneurs who recycle non-organics.

In 1997, APE began a cooperative training project with UNESCO targeting young people in Mokattam. Participants received training in recycling techniques, basic literacy, and mathematics. Once their training was completed, the youths began working with residents of another garbage village. These new trainees will, in turn, pass on their training to others.

In another project, APE conducted a source-separation pilot in two urban neighborhoods in Cairo. Residents in the pilots separated their discards into two fractions – food and non-food. Findings indicated that the scheme could be replicated and lead to more efficient recovery of materials from household discards, as well as produce compost free from contaminants and heavy metals. Furthermore, women would no longer have to sort soiled garbage and the health hazards to workers would be greatly reduced.

The program established by the zabbaleen of Mokattam has already been upgraded and replicated. In South Sinai, 90% of the discards generated by the entire town of Nuweiba is collected, recovered, and recycled based on the Mokattam model.

*ILSR estimated this tonnage based on survey data of 176 garbage collectors in Mokattam. The 176 collecting enterprises collect 375 tons per day or 124,800 tonnes per year.

**ILSR estimated the number of workers based on survey data of 176 enterprises, which have 598 men and as many youth and children collect waste while about 700 girls and women daily sort materials.

Sources:

The Informal Solid Waste Sector in Egypt: Prospects for Formalization (Cairo: Community and Institutional Development, January 2001).

Laila Iskandar Kamel, "Urban governance: The informal sector and municipal solid waste in Cairo," *archis*, December 2000. Available at <http://www.archis.org/> Site visited August 14, 2001.

Laila Iskandar Kamel, Managing Director, Community and Institutional Development, Cairo, Egypt, personal communication, October 25, 2001.

Benedict Faccini, "From Garbage to Gold in Cairo," *Sources*, Number 108, January 1999, UNESCO, pp. 6-8. Available at <http://unesdoc.unesco.org/images/0011/001148/114878e.pdf#114879>. Site visited August 20, 2001.

Association for the Protection of the Environment web site available at <http://www.ape.org.eg/>. Site visited August 27, 2001.

Composting

Composting turns organic materials into a useful soil amendment. This soil amendment enriches soil and reduces the need for chemical fertilizers. A high percentage of municipal waste in industrializing countries is organics. In India, for example, urban solid waste is 47% to 75% organics by weight.[65] Thus, composting plays a vital role in aiming for zero waste in the global South.

Five basic types of composting processes exist: (1) unaerated static pile composting, (2) aerated static pile composting, (3) aerated windrow pile composting, (4) in-vessel composting, and (5) vermicomposting or worm composting.

Unaerated static piles are better suited for small operations and generally cannot accommodate meat or grease. Aerated static piles and windrows can handle meat and grease with frequent turning and careful temperature and moisture control. In-vessel composters are enclosed, temperature and moisture controlled systems. They come in a variety of sizes, and have some type of mechanical mixing or aeration system. In-vessel composting can process larger quantities in a relatively small area more quickly than windrow composting and can accommodate animal products. Vermicomposting uses worms to break down organic materials into a high-value compost (worm castings). It cannot accommodate animal products or grease.

Composting source-separated organics is far superior to composting organics separated from mixed trash. A few U.S. communities have built facilities that compost mixed trash. These facilities can reduce trash as much as 50% by weight and roughly 60 to 80% by volume. However, composting non-source-separated material has an Achilles heel: the compost will be contaminated by toxic and non-biodegradable materials. Questions of compost quality and odor control hinder compost market development and continue to trouble the mixed waste composting industry in the U.S. Similar problems can be expected in the global South. Consider the experience of Delhi, India, which has three mixed waste composting facilities. Compost samples taken from plants were contaminated.[66] Furthermore, mixed waste composting, like incineration, destroys the resource value of discarded materials.

A recent report by the European Commission detailing 17 model composting programs in six European countries found that source separation of organics is critical to success:

> *"The successful diversion of biodegradable wastes from landfill relies on the separation of these wastes at source. Whilst the biodegradable fraction can be extracted from mixed wastes, this is laborious and produces a contaminated product. Separation at source offers the opportunity of a high-quality clean feedstock for composting and the prospect of an uncontaminated product."*[67]

The simplest, and generally least expensive, composting systems are those in which generators of organic materials compost segregated material on-site. Another option is to compost on a neighborhood scale. Large-scale composting requires collection of organic materials and transportation to a centrally located site where the material is aggregated. At the central site, materials can be composted in static or aerated piles or in more technically complex (and usually more expensive) in-vessel systems.

In the U.S., numerous communities have implemented comprehensive curbside and drop-off programs for residential yard trimmings as a way to achieve 50% and higher waste diversion levels.

Community recycling and composting initiatives can be scaled up to city levels, making privatizing and centralizing waste systems unnecessary.

Systems that compost segregated organics are far superior to mixed waste composting technologies. Mixed waste composting is more capital-intensive and thus expensive and produces a compost product contaminated with toxics and non-biodegradable materials.

Collected organics are typically composted in community-based, small-scale, low-tech systems that use windrows. The most comprehensive programs compost or chip into mulch: leaves, grass clippings, brush, garden trimmings, and Christmas trees.[68] In the commercial sector, new initiatives have proven successful in recovering food and converting it into valuable end uses. Many U.S. commercial sector programs focus on offering collection of source-separated food discards to restaurants, supermarkets, hotels, schools, produce markets, hospitals, prisons, and wholesalers. On-site, small-scale composting systems at schools and other establishments are also on the rise. These range from in-vessel systems to worm bins. Other food recovery options include food donations, processing into animal feed, and rendering (which is the process of heating and converting fat into products such as soap).

Communities do not need to make big investments in composting or build sophisticated industrial composting plants. Residents can produce compost from their organic scraps right in their backyards. Backyard composting represents the least-cost composting option available. Many local governments encourage backyard composting by providing households either free or reduced-cost backyard composting bins, holding educational and composting workshops, giving worms to schools, operating compost demonstration sites, and/or giving away home composting booklets. Seattle, Washington (U.S.) also trains volunteers to become Master Composters and operates a "Compost Hotline." Master Composters are required to perform 40 hours of outreach on composting following their training (they do outreach via school programs, composting demonstrations to community groups, staffing composting information booths, and writing articles for publication).[69] Alameda County, California, has a similar program. The county has sold more than 42,000 backyard compost bins since it began encouraging home composting in 1990. An evaluation of its program found that the average household diverts 263 kg of organics per year. Overall the county's backyard composting program diverts 10,500 tonnes per year.[70]

If home composting is not viable due to lack of space (such as in apartment complexes), composting at the building or block level may be feasible.

Vermicomposting — composting with worms — at the household and community level is one proven low-cost technique to divert organics from disposal. Vermicomposting is a decentralized activity requiring low or no capital investment.

Numerous projects have demonstrated the feasibility of composting in the global South. Examples that could be replicated include:

- The City of Marilao, Bulacan, the Philippines, 20 miles from Manila, implemented a municipal compost program in which the city offered increased collection frequency to residents who source-separated food discards. Two-thirds of the city's households joined the program. Some compost produced from collected kitchen scraps has been used to grow potted vegetables with the urban poor in mind.

- Patna, India, a city of one million people has few municipal waste services. The city

provides little door-to-door waste collection, and does not operate any composting facilities or sanitary landfills. Some of the city's apartment dwellers have created an innovative way to handle their organic discards using their balconies and window sills. Residents combine organic waste, soil, floor sweepings, and dried moss from roof tops in clay pots. The mixture matures into compost in three to four months. Residents use the finished compost to grow flowers, ornamental plants, spinach, and tomatoes.[71]

- Many vermicomposting projects exist in India. Mumbai (formerly Bombay) has 600 neighborhood associations that manage their wastes; many of them vermicompost their organic discards. In addition, nongovermental organizations in Mumbai operate Neighborhood Vermiculture Facilities, with a capacity of 5 tonnes per day. These groups work with ragpickers to divert recyclables to markets and turn organics into vermicompost. The facilities cost less than Rs1.25 (US$0.03) per kg to operate and provide jobs to the poorest of the poor. In Pune, many individuals produce and sell vermicompost for Rs5 to 20 (US$0.10 to $0.40) per kg.[72]

- Paharganj and Chandni Chowk, in Old Delhi, India, are two of the most crowed parts of Delhi. As a result, finding a site for composting was difficult. The limited open space is used as a green park for children. Meanwhile, residents burned waste daily as a means of disposal. To remedy this, the nongovernmental organization Chintan developed a small composter that is aesthetically acceptable as well as sized appropriately for small homes. The composter looks like a big pot, is aerated and simple to use. It has proved successful. Even homes with only one room are using it to compost instead of burning their discards.[73]

- The Direccion General de Servicios Urbanos (DGSU) in Mexico City is in charge of the city's solid waste management programs and maintenance of public gardens. In 1994, the organization began collecting grass clippings, leaves, and branches produced during garden maintenance. It windrow composts more than 35 tonnes of material a day. DGSU uses the finished compost as soil amendment for the public gardens and in planting along roadways.[74]

- The Thai military, in cooperation with the Bangkok Metropolitan Administration, the Department of Land Development, the Pollution Control Department and a private foundation implemented a project to train soldiers in composting practices. The project turns organic material discarded at the camp into useful fertilizer while reducing disposal needs and trains the soldiers in waste separation and composting.[75]

In the U.S., marketing compost produced from source-separated organics has not presented a problem. Communities with small-scale government-owned compost sites typically give away compost and use it on government-owned property. Compost revenue sales are not critical to their financial viability. The avoided costs of disposal make compost operations cost-effective. Privately-owned composting facilities likewise do not solely depend on compost revenues to cover their costs. They typically charge haulers delivering material per ton tip fees at the gate or have contracts with local government to process collected organics.

In the global South, the avoided costs of disposal may not cover composting costs. Disposal costs tend to be low, thus operations may not attract deliveries if they charge tip fees to cover their costs. Haulers may simply choose to dump material rather than compost it. Thus facility operators in the global South may need to use different funding vehicles. Government can play an active role in securing investment sources. Receiving adequate

revenues from compost sales might break or make a facility in the global South. Here too government can play a vital role in building markets for compost. It can buy compost. It can help market compost. It can help educate potential compost users to its benefits. It can level the playing field between compost and chemical fertilizers by eliminating subsidies for chemical fertilizers (if these exist) or creating equal subsidies for compost. It can deliver compost free of charge to small-scale farmers (if regular supplies of biomass are available for free, farmers themselves will reduce their use of chemicals). It can encourage backyard and neighborhood composting projects as the first priority as these composting techniques are decentralized activities that require low or no capital input. All of these initiatives could be done at a far lower cost than building an incinerator or new landfill.

Barangay Bagumbuhay, The Philippines

Barangay Bagumbuhay (the Philippines) diverts 52% of household discards from dumpsites

Barangay Bagumbuhay (New Life) is a medium-size, low- to middle-income barangay* with about 1,200 households and a population of about 7,400. It is in the 3rd District of Quezon City, one of the cities comprising Metropolitan Manila. In August 2001, the Barangay Council started its Ecological Solid Waste Management with the help of Mother Earth Unlimited, a nongovernmental organization based in the same city. After attending a seminar-workshop facilitated by Mother Earth Unlimited, the Council, which is headed by the Barangay Captain, conducted an information, education and communication campaign among the households on the proper management and recovery of discards.

Residents put their kitchen discards in old plastic containers (basins, pails, or plastic bags).

Barangay Security and Development Officers (BSDOs), popularly known as Barangay Tanods, initially collected the segregated waste on a daily basis using pushcarts that hold 17 kg plastic drums. There was no budget at the start to pay for eco-aides, so the existing staff of Tanods was used. The organics were composted in 5 manually operated composting drums at the start of the program. These steel drums have now deteriorated and are not being used.

A TV program featured the barangay initiating an eco-waste management program. Soon thereafter in March 2002, the Department of Environment and Natural Resources (DENR) gave the barangay a 2-tonne stainless steel composting drum. In September 2003, the barangay acquired another 2-tonne drum.

The Quezon City Mayor offered an incentive to barangays that can substantiate they saved the city money in its waste budget. Under this scheme, a barangay will receive 50% of its savings and can use this rebate to sustain its waste management program.

Barangay Bagumbuhay has qualified to apply for this and is set to receive P364,000 (~US$ 6,700) in 2003 for its savings of P728,000 (~US$ 13,500) to the City Government's cost of waste disposal. The Barangay Council approved a motion of the Captain to use their barangay fund to buy another 2-tonne composting drum. With the expected rebate for 2003, they expect to hire additional 2 gardeners and 2 eco-aides.

The barangay generates about 407 kg of waste daily. Food waste collected is about 204 kg. Three Barangay Tanods collect 12 drums of 17 kg capacity everyday. Garden waste (28 kg) is shredded and

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Mature composts are sieved before repacking to ensure good quality. © Mother Earth Unlimited

Barangay Bagumbuhay, The Philippines

	PH Pesos	US $
Equipment/Buildings		
2-tonne stainless steel mechanical composting drums (3 x P120,000)	P360,000	6,545
Pushcarts	7,500	136
Extractor	18,000	327
Shredder	120,000	2,182
Ecology Center (site preparation, warehouse, drainage, etc)	65,000	1,182
Activator (P9900 x 6)	59,400	1,080
Sub-total Equipment/Buildings	*629,900*	*11,452*
Labor/Personnel		
5 sweepers/gardeners (P2,000/mo x 12 x 5)	120,000	2,182
3 barangay Tanods (P2,500/mo x 12 x 3)	90,000	1,636
3 eco-aides (P2,500/mo x 12 x 3)	90,000	1,636
Sub-total Labor/Personnel	*300,000*	*5,454*
Total expenses for 1st year	**929,900**	**16,906**

Source: Raulito Datiles, Barangay Captain, Barangay Bagumbuhay, Project 4, Quezon City, Philippines, May 2003

added to the kitchen waste in the composting process. Total organic waste is 232 kg. These are brought to the Ecology Center where three eco-aides oversee composting and maintenance of the Ecology Center. Five women tend to the garden and clean the surroundings. These women also take care of repacking the compost. Activators (mainly lactobacilli) are used to hasten composting. Compost is harvested after five days.

Recyclable materials (paper, cartons, plastics) are also collected and sold daily to the nearby junk shops. Other plastic discards that are not sold are brought to the warehouse and are picked up by garbage trucks.

In 2002, City Hall estimated that 52% of discarded material was diverted from the dumpsite. The number of trucks collecting trash twice a week decreased from 10 to 4.5. In 2003, with the additional two composting drums, garbage collection dropped even further to 1.5 trucks per week. By the end of 2003, waste diversion was expected to be 65%.

The barangay issued a waste management ordinance more stringent than the City Government's requirements. Aside from requiring basic segregated set-out, collection, composting, and recycling, the ordinance requires business establishments to undergo solid waste management training as a requisite for receiving an operating permit.

The salaries of the eco-aides, Tanods, sweepers and gardeners are augmented by the sale of compost, plants and recyclables. They sell compost at P100 / sack (~US$ 2/sack) or P5/kg (~US$ .10/kg) . Plants are sold in a churchyard on Sundays and also in a public market. The DENR contracted with the Council to landscape the DENR's front garden, giving the barangay additional earnings.

The Council has resolved that all the barangay projects will aim to sustain its ecological waste management program.

This program has spurred active community awareness of and participation in ecological waste management at the barangay. In addition, the program has led to a virtually trash-free landscape and cleaner surroundings, job generation, and has saved the government avoided costs of disposal.

* Barangay is the smallest unit of government in the Philippines. A barangay has a captain and a council. It can formulate its own ordinances needed for governance.

Source: Raulito Datiles, Barangay Captain, Barangay Bagumbuhay, Project 4, Quezon City, the Philippines, personal communication, December 2003.

Advanced Locality Management, Mumbai, India

Neighborhood associations recycle and compost in Mumbai, India

In Mumbai (formerly Bombay), citizens have set up separate neighborhood associations – known as an Advanced Locality Management (ALM) – in which members keep their environment clean and recycle and compost their discards. Each ALM represents a collaboration among residents, shopkeepers, and the Municipal Corporation of Greater Mumbai (MCGM). Individual ALMs comprise up to 1,000 houses and other establishments. A committee of residents and local business people collaborate with MCGM to improve their environment. Neighborhoods have to follow general rules and conditions and apply to become an ALM. Every locality, for instance, should have a Locality Committee that meets weekly. Residents are asked to keep their area clean and separate their discards into biodegradable and non-biodegradable types. ALMs vermicompost wet material and work with ragpickers to recycle discards. The heart of the system is getting residents to take responsibility for the material they generate and participate in its management. The ALMs also operate on the principle of locally managing discards to reduce costs and inconvenience. The system is incredibly cheap to set up and provides jobs to the poorest of the poor (while accepting them as useful workers in protecting the environment and conserving natural resources).

The ALMs grew out of an effort spearheaded by the community group, Save Bombay Committee. In 1996, Priya Salvi, Save Bombay Committee's Project Coordinator, prepared an Integrated Solid Waste Management Programme based on the "3Rs—Reduce, Reuse, and Recycle" concept and the "cradle-to-grave" approach. The Programme aims at 100% reutilization of discards with active citizen participation for creating zero garbage. The MCGM serves about 12 million people and handles 6,000 plus tonnes per day of municipal discards. In June 1996, the Municipal Commissioner Chief Executive Officer of the MCGM announced in a specially-called citizens meeting that the MCGM would implement the Integrated Solid Waste Management Programme. When the MCGM was slow in following through, Save Bombay Committee staff volunteers started directly advocating that citizens handle their discards on a community basis in their area by forming local resident associations for this purpose. Senior municipal officers participated in the first Save Bombay Committee seminar in a resident association and were surprised to find citizens taking responsibility for their discards. The MCGM extended and entered into a Memorandum of Understanding, which became the Advanced Locality Management (ALM). Citizens agree to take responsibility for their discards with MCGM help.

In 1997, the first ALM began in Joshi Lane, a locality in Ghatkopar, a suburb of Mumbai. By 2002, 650 ALMs existed in the city and its suburbs, representing the participation of about 300,000 citizens (about 60,000 households).

The Integrated Solid Waste Programme recommends that residents segregate their discards into recyclable, organic, and inert building material components. Though the MCGM has recently directed residents to segregate materials into recyclables and organics, the practice is not fully implemented.

Residents tend to segregate newspapers and plastics for sale to scrap traders or for handing over to ragpickers to divert to markets. Most other discards are tossed into municipal waste bins, located at different junctions and busy areas on pavements. Ragpickers then literally pick through

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A Mumbai ragpicker recovers recyclable materials to generate income.
© Save Bombay Committee/Prakruti

Advanced Locality Management, Mumbai, India

Worm castings and compost humus produced from the worms is a valuable soil conditioner. © P. Salvi/Save Bombay Committee/ Prakruti

material in the bins taking what they know will have resale value (such as newspapers, stationery, plastics except flimsy plastic bags, glass, leather items, and rags). Quite often ragpickers will have an understanding with a household to collect its discards daily (usually for Rs 50 to 100 per month — ~US$1 to $2). In these cases, residents hand over all their discards to the ragpicker who removes recyclables and deposits the organics in the municipal bin. Households discard other material in front of their homes. MCGM has a separate department that collects and hauls these discards to "dumping yards." The MCGM also collects and dumps the mixed organics deposited in the municipal bins.

The ALMs have their own arrangements for collecting discards from households. They set up vermicomposting and quite often use the worm castings for greening their area. They also deposit organics in large plant pots.

Women rag pickers carry a "gunny" or a used and often tattered HDPE bag for collecting recyclables. When the bags are full, they sell what they have collected to a nearby local trader, who then resells the material to recyclers. Ragpickers generally have no equipment. A few might have a three-wheeled handcart.

Mumbai has about 300,000 ragpickers who survive on collecting, cleaning, and selling recyclables to recyclers. Their earnings range from Rs 50 to 100 per day (~US$1 to US$2). For the ragpickers, the poorest of the poor, the ALMs are their only hope of sustenance. Traditionally Mumbai's ragpickers have been a highly maligned people. The introduction of the Integrated Solid Waste Management Programme has improved their plight.

The authorities and citizens have started recognizing the crucial role the ragpickers play in conserving natural resources and protecting the environment. Ragpickers are gaining more self-respect and community recognition for the valuable work they do. Whereas the ALMs cover only 300,000 residents, ragpickers more or less "process" waste from the entire 12 million people in Mumbai.

Fewer than 10% of ragpickers are organized into ragpicker associations and these associations are not recognized by the authorities. Ragpickers are not protected in Mumbai (this is generally the case throughout India).

Residents are encouraged to vermicompost (composting with worms) their organic discards either individually or on a community level through the ALM. Few do so individually, choosing instead to take their organics to a common vermicomposting "bed" for community organics. Vermicomposting can process organics from one to 100,000 families. A few residents not forming any part of any ALM vermicompost their own organics. In a typical ALM, the association organizes discard collection through its specially appointed staff, normally a rag picker couple. The staff segregates waste, diverts recyclables to markets, and helps the ALM vermicompost the organics. Some ALMs use earthen garden pots of 30 cm and bigger to deposit their organics or they build bins for vermicomposting. About 1 square meter of space is required for handling the organic material generated by 10 people. Sometimes the MCGM gives open space or a part of a nearby garden for this purpose.

The Save Bombay Committee has helped ragpicker associations set up their own small-scale vermicomposting facilities. Five units are operating. MCGM provided the land, constructed vermicomposting bins (according to Priya Salvi's design), provides electricity and water, and delivers 5 tonnes of mixed discards per day free of charge to each site. The material — mostly organics — is collected from the municipal bins from which ragpickers have already retrieved recyclables.

The vermicomposting process itself is relatively simple. Organics are fed to earthworms in beds. Earthworms are supported by millions of microorganisms. Depending on the site conditions and maintenance, organic discards are biodegraded in 30 to 45 days. Workers regularly

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Advanced Locality Management, Mumbai, India

spray water to maintain the temperature below 30 degrees Celsius. Bins have to be in the shade for the earthworms to do their work. Worm castings or compost humus produced from the worms is a valuable soil conditioner. It becomes the property of the ragpickers and provides some additional income earnings when they sell the product to farmers. Through these vermicomposting plants, which have minimal start-up costs (Rs 20,000 at most — ~US$400), the MCGM saves RS 1,100 per tonne — ~US$22 — in avoided handling and disposal costs.

A big tub where compostable materials are processed. © Save Bombay Committee/Prakruti

Since 1996, when Save Bombay Committee volunteers started providing technical assistance, training, and education, vermicomposting has become popular and accepted as a convenient practice in many neighborhoods. However, lack of space as well as clear leadership from the authorities to segregate and process organics hamper further progress. In addition, the Indian government subsidizes chemical fertilizers making it more difficult for vermicompost (worm casting soil conditioners) to compete, especially when cost to haul worm castings to farmland has to be covered. As Save Bombay Committee's president Kisan Mehta says, "worms operate invisibly in the soil, their work is not as appreciated as much."

Most ALMs were initially funded by small contributions from each household in the program. As the programs mature, citizens are finding ways to make the ALMs financially self-sustainable. "Last year we sold Rs 10,000 [~US$200] worth of manure from our vermiculture bins," says Madhulika Mundada of an ALM at Sahar, Andheri.

In the ALM communities, an estimated 70 to 75% of municipal discards is diverted from disposal. Unrecovered material is dumped. The Integrated Solid Waste Management Programme recommends vertical deposition of inert building material (vertical to conserve space), with the idea that a 20- to 100-meter high hill would rise in the next 20 to 25 years that could be landscaped. This practice has not occurred and inerts are dumped.

The benefits of ALM reach far beyond waste management and include reduced costs to local waste management authorities, reduced maintenance and cleaning costs for sewers, and reduction in the incidence of diseases related to poor sanitation, such as malaria and gastroenteritis. Another important benefit is the impact of the vermicompost (worm casting soil conditioner) on farmland. Unlike chemical fertilizers, the soil conditioner produced from vermicomposting need only be fed to the soil once in a while. It contains biodegraded organic matter and millions of beneficial microorganisms and worm eggs. They proliferate and spread in the soil so repeat spraying is avoided. An initial feeding of two tonnes of soil conditioner per hectare may be all that is needed. In five years, about 100,000 worms would be found in a hectare of land. Thus, vermicomposting has the capacity to turn soil into a living medium that provides optimum plant food continuously and in increasing amounts as time passes. This is not the case with chemical fertilizers.

Sources: Personal communication with Kisan Mehta, President, Save Bombay Committee, Mumbai, India (August 20, 2001; September 2, 2001; May 26, 2002; June 2, 2002; and June 3, 2002); Shiv Kumar, "Mumbaiites resort to self-help to tackle civic issues," India Abroad News Service, June 5, 2000; and "What is the ALM?", published on http://www.alm-municipal.com (no longer available).

Exnora International, Chennai, India

A nongovernment organization, Exnora, spawns decentralized recycling/composting program in India

Exnora International is a secular, nonpolitical, nonprofit and nongovernment environmental organization founded in 1988 that promotes zero waste practices. Headquartered in Chennai, India, the organization seeks "ideas that are EXcellent, NOvel & RAdical and that improve sanitation, protect nature and build a strong nation." Exnora International has spawned a decentralized movement by creating community-based organizations, known as Civic Exnoras, which are decentralized networks made up of and run by residents. Civic Exnoras aim to bring residents together and collectively enable them to solve their own civic problems. As of 2001, 17,000 Civic Exnoras existed in India, many of them with solid waste management projects. Exnora International's zero waste program involves setting up decentralized Zero Waste Centers and building capacity among Civic Exnoras, other community groups, and municipal agencies to start and run their own Zero Waste Centers.

Exnora International promotes a two-tiered decentralized model of discard management: (1) primary source separation into two categories (recyclables and compostables with home composting encouraged) in each household by each resident, and (2) a secondary extensive sorting of materials by workers, called "Street Beautifiers," at neighborhood Zero Waste Centers. This strategy keeps the system simple and convenient for households. The Street Beautifiers are motivated to do the extensive secondary sorting as they earn wages to do this and can earn additional income from the sale of recyclables. The secondary sorting is done on the same day as the household collection, so odor and bacterial activity do not present problems. Under this model, an estimated 90% of discards is reused, recycled, and composted. The remaining 10% is landfilled.

The Cochin Municipal Corporation is one government agency that has embraced Exnora's zero waste program. After operating several pilot programs, the Corporation is planning to expand the program to all its 67 municipal wards. Cochin has a population around 6,000,000 and generates 320 million tonnes of municipal discards.

Involving the public:

There are two important facets to Exnora International's zero waste approach: technology and psychology. Technology is needed to recycle and compost, but people will not participate if they are not motivated or environmentally conscious. Thus, Exnora devotes much attention to public outreach and training, in addition to providing the means to recycle and compost.

Pushcarts are designed to motivate community members to participate in waste segregation. © Exnora International, India

Its messages to the public include:

"Pile up and perish or clean up and flourish"

"Disease or money — Throw garbage, get disease; recycle garbage, get money."

"All good things begin with me."

"Don't waste money on waste. Make money from waste."

"Haste makes waste."

Exnora International's model zero waste program for the Civic Exnoras involves setting up three meetings to facilitate resident participation and

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Exnora International, Chennai, India

involvement in the program: (1) an introductory meeting for spurring resident motivation and awareness, (2) an information meeting for facilitation and support, and (3) an initiation meeting for program inauguration and launching. By attending these meetings, residents will become environmentally aware, know the do's and don'ts of the program, will be motivated to participate and cooperate, and will become enthused to create civic and environmental awareness among their family and neighbors.

Household collection containers:

Households are asked to place their organic kitchen discards in a green 5- or 10-liter bin or a bin labeled with a green strip (which residents can paint or stick on). Recyclables go in another 5- or 10-liter bin, basket, or bucket, which is either white or red or labeled with a white or red strip. Other options for containers can be jute or urea bags (plastic woven sacks) or even cardboard boxes. Exnora suggests flexibility in allowing residents to use and pay for bins. For instance, residents can use baskets and/or bags they already have in their home, the local government can provide containers free of charge, the people and government could share the costs, the baskets could be provided through donors' sponsorship, or the cost could be partly borne by residents and partly through sponsorship. To further clarify the purpose of the containers, Exnora suggests pasting a sign on each in the local language. The bin for organics could be labeled, "Compostable Waste (organics/wet/natural)" and the bin for recyclables could be labeled, "Recyclable Waste (inorganics/dry/manmade) Paper, Plastics, Metal, Glass & Others." In addition, Exnora recommends indicating the flat/house door number on each bin. Households can use any number of bins as needed inside the home. They are asked to transfer material to one set of 10-liter containers kept outside the home, which will be emptied by the collection worker. Residents are encouraged to wash their containers every day after emptying. Nonrecyclable and noncompostable materials can also be placed in a black bin (located at the Zero Waste Centers) that is emptied and collected by the municipal authority.

Garden waste:

Exnora teaches households to home compost any garden material. Its rationale is straightforward: "If there is generation of garden waste, it means there is a garden and space too. Then the best way of avoiding the trouble of handling the voluminous garden waste is to compost it in the garden itself through one of the few simple composting forms [such as pit, drum, and windrow]." For households that choose not to home compost garden material, Exnora suggests that they keep garden material inside the compound in a bamboo basket for the Street Beautifiers to collect.

Materials for the Green Bin	Materials for the Red or White Bin
vegetable peelings	waste paper/cardboard
sweepings	plastics
food scraps	broken glass and bottles
coconut shell	wood
coal	metal
ash	rags
plants	shoes and slippers
leaves	mineral water bottles
broom waste	broken ceramic pieces
hair	leather and rubber items
dry flowers	used note books
dead insects/lizards	all cosmetic wastes
waste tea and coffee grinds	
egg and crab shells	
garden waste (in bamboo basket inside the compound)	

Residual waste ("absolute" waste):

Household hazardous wastes includes light bulbs, chemical wastes, automobile wastes, domestic medical wastes, and batteries. Exnora does not recommend a third container for this category of discards as a third sort would make what is now a simple activity at home too complex, add to costs, and occupy further space. Instead, residents are asked to place inorganic/hazardous nonrecyclable materials in a bag or pack it in newspaper for pick-up by the Street Beautifiers. Eventually this type of waste along with other noncompostable and nonrecyclable items (such as sanitary napkins and mosquito mats) will go in the black bin to be handled by the local municipal authority. For some of these products and materials, no safe disposal option exists and prevention is the only real solution. extended producer responsibility and other regulatory tools to reduce the volume and toxicity of waste may motivate producers to phase out hazardous or problematic materials from their products and processes, leaving only materials which can be safely reused, recycled or composted.

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Exnora International, Chennai, India

Buildings/complexes with multiple households:

Residents who live in buildings or complexes with multiple households can transfer their materials to 50- or 100-liter green, red, and back drums (with lids) that are located outside on each block. For these households, hazardous, non-recyclable inorganic materials is placed inside the black drum as at least a few households generate this type of material each day. Alternatively, a small Zero Waste Center could be set up within the flat complex itself.

Collection:

Households undertake the primary separation of materials and set out their discards in green and white/red containers. Workers, called "Street Beautifiers," use three-wheeled collection carts to collect segregated organics and recyclables. In 1988, Exnora converted the traditional three-wheeled fish transport cart for transportation of discards. Today, thousands of cycle carts are in use carrying recyclables, compostables, and trash in and around Chennai as well as in many other cities in Tamil Nadu and other south Indian states. Advantages of the cart include its use of pedal energy versus petrol energy, its small size compared to conventional municipal trucks enabling its use in small streets and lanes, and its ease of use and reduced strain compared to push carts. The back half of the Exnora cycle carts are painted green, while the front half is painted white or red. Most Beautifiers have two to four 50- to 75-liter green containers and similar numbers and sizes of white or red containers in the cart for collection of recyclables and compostables. Others use metal dividers as partitions to keep the materials segregated. Another alternative for big areas is to have one green cart devoted to collection of organics and another cart devoted to collection of recyclables. If a system of keeping inorganic non-recyclable waste separate is adopted, the Street Beautifiers will take the plastic bag containing the waste and empty it into one or more big urea sacks tied to their carts.

Exnora recommends the following for Street Beautifiers:

- Provide each worker with a full uniform and cap, face mask, boots, and gloves
- Create a health record for each worker
- Note his blood type
- Do medical check-up once every three months
- Supply two bath soaps per month
- Provide first aid kit, tool box, drinking water bottle, a tricycle maintenance register, and a complaint register in this tricycle (registers can go in a box fitted to the cart).

Zero waste centers:

The Street Beautifiers deliver collected materials to the nearest Zero Waste Center, which is basically a shed with a roof and a sloping cement floor. The Street Beautifiers undertake an extensive secondary separation at the Center. The Center has nine to ten 200-liter used metal or HDPE bins/drums which are color coded (they are either painted or to save paint a small color strip is painted on each drum). There are two to three green bins for organics, one white bin for paper, one blue bin for metal, one red bin for plastics, one yellow bin for glass, one gray bin for reusable items (such as wood, cloth, shoes, bottles, and other containers), and one black bin for residual or "absolute" waste. Recyclable/reusable materials are sold to shops, recycling industries, given to Street Beautifiers as part of their wages, donated to orphanages, donated to ragpickers who can regularly pick up materials, and/or allowed to be taken to Civic Exnora-approved micro-enterprises (which may be nothing more than one or two youth joining together in a business arrangement).

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Collection bins are color-coded to make segregation easier.
© Exnora International, India

Exnora International, Chennai, India

Approximate equipment cost for program serving 150-200 families

	Cost/Unit (Rs.)	Total Units	Total Cost (Rs)	Total Cost (US$)
Household green bin	30	150	4500	90
Household red bin	30	150	4500	90
Exnora trash collection cart	8000	1	8000	160
Bins for cart	400	6	2400	50
Worker uniforms, tools			1500	30
Zero Waste Center shed	7300	1	7300	150
Bins for center	400	10	4000	80
Labor, transport, other			2000	40
Total			**34,200**	**700**

There are multiple green bins as the organic material is composted in the bin/drum itself and only removed when the compost is mature. Sometimes a partitioned masonry bin with holes is constructed and used for composting. The strong masala (spices) in food discards has been found to inhibit bacterial activities necessary for composting. A water wash for food discards takes care of this problem. The Street Beautifiers empty organic material into the top of the green bins and level the top with a stick. They sprinkle a little soil on top. The roof ensures that rainwater does not enter the bin, thus avoiding excess water problems. After the Beautifier completely fills each bin, he seals the top with a 1-inch layer of soil and leaves the bin undisturbed for three months for the anaerobic composting process to take place. The manure that forms can be removed by lifting the bin. Sieves are sometimes made and used to screen the manure. Exnora recognizes the superior fertility content of compost produced from vermicomposting. Thus it recommends that Civic Exnoras experiment with different compost techniques and select the most suitable type. Finished compost can be sold, given to residents, used in the neighborhood, or by Civic Exnora-run micro-enterprises. In Cochin, a three-chambered compost yard was constructed. In the first chamber, organics undergo bio-dung composting, vermicomposting in the second, and microbial composting in the third. The Cochin Municipal Corporation uses the finished compost in its local parks.

One Zero Waste Center serves 150 to 200 families. The Centers utilize a small piece of land and are located on street corners, corners of playgrounds, corners of Municipal Ward Office compounds, public open space, private land, school compound corners, leased land, and/or land owed or leased by an entrepreneur. The Centers are kept clean and many are decorated with ornamental plants. They are nicely painted and are adorned with a big sign labeled, “Exnora Zero Waste Centre.”

Collection centers for reusables:

Exnora recommends that educational institutions house collection centers for reusable items such as furniture. Schools can have a small room on their premises dedicated to this purpose, a Reusables Collection Center can be constructed out of discarded materials, or even an old truck could be converted into a center. Teachers, parents, students, and people living near the school can be asked to bring their unwanted reusable items to the center. The manager in charge of the center can, for instance, take steps to make old furniture useful. He can enlist the help of students to repair and paint furniture, which can then be sold or donated to the needy.

Exnora infrastructure:

Civic Exnoras are members of the Forum of Civic Exnoras, a federation which operates at the Division/ Ward levels and are supported and guided by a larger organization, the Exnora Innovators’ Club. If any Civic Exnora is not successful in solving its problems, it can go to the Forum of Civic Exnoras, the Exnora Innovators’ Club, District Exnora, State Exnora and/ or Exnora International. The Exnora Innovators’ Club has office bearers in each neighborhood who act as liaisons with each government service provider (such as the Municipal Authority or the Electricity Water Board). The role of these office bearers is to continuously and consistently take up people’s civic issues and systematically pursue them. The Exnora Innovators’ Club identifies and inducts full-time and

(continued next page...)

Exnora International, Chennai, India

part-time volunteers. Civic Exnora sees itself as recognized, valued, and welcomed by local government authorities. Exnora presents a two-way approach to tackling civic problems. People's problems are taken to the government and the government's problems are taken to the people. According to Exnora, the organization is about finding solutions as much as it is about identifying problems. It aims to mobilize people to collectively identify problems, find solutions, draw plans, present problems and solutions to government, and pursue solutions with appropriate authorities. The Exnora Environmental Training Institute provides on-the-job training for citizens and classroom training. The Exnora Environmental Research Institute carries on ongoing research.

Exnora has grown from an anti-garbage campaign to a full-fledged people's movement for environmental protection and management. In 10 years, its members have grown from 20 to about 300,000.

Replication:

Exnora's zero waste program is applicable to hotels, hostels, nursing homes, office, and other commercial and institutional settings. For instance, hotels can have two containers per room, classrooms can have two containers per classroom, and markets two containers per shop. Several schools, hotels, hospitals, and offices participate in Exnora's program. Exnora's program can be modified to suit local conditions, awareness levels, people's habits, money available, space available, and time available.

Costs of system:

Costs of the system are minimal. For a program serving 150 to 200 families, equipment costs less than Rs 40,000 (US$820) and worker wages and maintenance of cart and Zero Waste Center costs about Rs 2,500 (~US$50) per month. In addition, the sale of compost and recyclables generates a minimum of Rs 2,000 (~US$40) per month.

There are several options for covering the cost of the Street Beautifiers' work:

- Municipal Authority workers could become Street Beautifiers and stay on the Authority's payroll
- Residents collectively can help the Authority by directly employing the workers; thus, the private worker could be paid out of subscription fees from residents (in Cochin, households pay collection workers Rs 10 per household per month).
- A business could adopt or sponsor a road/ place meeting the expenses
- Workers can be given ownership over the materials instead of wages
- Workers can be given separated recyclables plus cash incentives
- A joint effort with professional rag pickers may be worked out
- The cycle cart can be sponsored by the local government or businesses; workers can buy or acquire the carts either through sponsorship or a bank loan. (In Cochin, for example, the Rotary International Club sponsored some of the cycle carts.)

In fact, the avoided costs to local government from not having to collect and transport waste to dumpsites more than covers implementation and operating costs of Exnora's zero waste program. Local government spends approximately Rs 20,000 (US$400) per month to collect, transport, and dispose of waste from 200 families. This cost covers street sweeper salary, driver, truck workers, cost of fuel, supervision cost, truck maintenance, truck depreciation, landfill cost, cost of tools, and cost of infrastructure such as dust bins.

With Exnora's program, the disposal cost of Rs 20,000 per month is avoided, trash truck pollution is stopped, landfill space is saved, landfill pollution is avoided, and waste is converted into wealth.

Source: M. B. Nirmall, *Model Area: All About Zero Waste Management* (T. Nagar, Chennai, India: Nurture Nature Foundation, January 2002); and Exnora's Web site at www.exnora.org (browsed June 2002).

The avoided costs to local government from not having to collect and transport waste to dumpsites more than covers implementation and operating costs of Exnora's zero waste program.

Teoville Village, Parañaque City, The Philippines

A Philippine village, Teoville, segregates household discards into wet and dry categories for composting and recycling

Teoville is a village in Sucat Parañaque City, located in metropolitan Manila (the Philippines). It has 105 households, which generate about a tonne of household waste each month. In the past, garbage collection and disposal did not pose a big problem for the community. Garbage was collected at least once a week. One day, however, the villagers woke up with piles of uncollected garbage. Some local dumpsites had closed.

Rotary composting drums are being used to process biodegradable materials.
© Celia Giron

Believing in the maxim that for every problem, there is a corresponding solution, the Parañaque chapter of the Young Women's Christian Association (YWCA) saw the crisis as an opportunity to help the community. It adopted composting as its banner project in cooperation with the Teoville Homeowners Association.

In November 1999, the YWCA started a composting project. It held regular meetings and seminars every other week for six straight months to teach homeowners how to segregate their discards into wet and dry components (biodegradables and recyclables, respectively). The seminars focused on composting and covered composting procedures, objectives, and its problems and benefits. Some homeowners were initially skeptical about the program. They later participated when they saw the positive effects and advantages of the composting project.


Some communities uses motor-driven composters to hasten maturing process of the biodegradable wastes.
© Celia Giron

The program has nurtured certain values among homeowners: discipline, cooperation, and environmental consciousness. Households diligently segregate their recyclables and biodegradables. Recyclables, which include paper, cartons, plastics, and bottles, are collected three times a week. They are sorted, cleaned, and sold to "junk buyers." The "bioman" collects biodegradables every day. He takes the organic material to a central composting site where biotechnicians use a composting drum to compost material. The finished compost product is used as an organic fertilizer for vegetable gardening. The Parañaque office of the Bureau of Lands and Agriculture provides YWCA with vegetable seeds and planting assistance. In addition to the YWCA using the compost in bio-intensive gardening, the compost is also packed in one-kilogram bags and sold for P10 (~20 US¢) per bag to homeowners and to neighboring communities. Proceeds from compost sales and from sales of recyclables to junk buyers are shared by the YWCA and the Teoville Homeowners Association and cover program costs such as the wages of the bioman and the biotechnicians.

Teoville no longer depends on the government for its garbage collection and disposal.

Source: Celia Giron, the Philippines, personal communication, June 5, 2002.

Barangay Sun Valley, The Philippines

Barangay Sun Valley (the Philippines) diverts 59% of its municipal discards

Barangay Sun Valley is home to 31,360 people in 5,600 households. Approximately 3,000 households participate in a recycling and composting program that diverts about 70% of their household discards from disposal. Each person generates an estimated 0.5 kilogram of waste per day; of this, 0.25 kilogram is composted and 0.1 kilogram is recycled. Overall diversion for the barangay is about 59%. Approximately 50 tonnes per month are recycled, 126 tonnes per month are composted, and 299 tonnes per month are landfilled.

Most neighborhoods have house-to-house collection service. "Biomen" collect segregated organic discards (all kitchen and yard waste) on a daily basis using pedicabs. One pedicab serves about 200 homes. The biomen deliver the organic material to a composting center, where it is mixed with mulch, coco-dust, and "hasteners" using a concrete mixer. The mixture is then placed in ordinary rice sacks and left to dry and aerobically biodegrade on static piles for 15 to 21 days. When dried, the material is shredded, sieved, and put back into the rice sacks for maturing, after which it is repacked into 1- or 2-kilo bags or in 30-kilo sacks for sale.

The same pedicabs collect recyclables from households. Collectors deliver recyclables to the nearest "eco-shed" for further sorting and baling. Processed material is sold directly to junk shop dealers.

Households without collectors place their organics daily in strategically located compost bins. These bins are managed daily to control odor and enforce segregation. Once a week, the biomen will collect and empty these bins onto a paved area where they will mix the organics with mulch, coco-dust, and hasteners. They then place the mixture into rice sacks, which they drop off at the barangay truck for delivery to the composting site.

On the same day the community compost bins are collected, residents bring their recyclables to the collection area, where materials are sorted using sacks. Paper goes in one sack, plastics in another, and so forth. After the specified time limit has expired, all sorted recyclables are loaded on the barangay truck for delivery to the barangay's central warehouse. There, materials are sold to junk shop dealers.

Costs for the program are minimal. Total equipment costs were about P527,000 (~US$10,600). Operating costs include wages for biomen, truck personnel, and compost processors. Composting costs about P2.25 per kilo of finished compost (this is about US$0.04 per kilo). The compost can be sold for P3 to P5 per kilo (US$0.06 to $0.10 per kilo), depending on the volume.

Total equipment costs of the project

	Per Unit Cost (Philippine Pesos)	Total Cost (Philippine Pesos)	Total Cost (US$)
Eco-Shed (# NA)	150,000	150,000	3,000
Electric concrete mixer (1)	35,000	35,000	700
Shredder (1)	150,000	150,000	3,000
Pedicabs (28)	6,500	182,000	3,650
Other equipment		10,000	200
Total		**527,000**	**10,600**

Source: Roberto B. Guevara, Barangay Sun Valley, the Philippines, personal communication, June 1, 2002.

Manufacturing

The final step in recovery of discards is using recovered materials as feedstock in new manufactured goods. In many industrialized and industrializing countries, virgin resources are scarce and must be imported. Recycling discarded materials can lessen dependence on imported goods, while providing employment and reducing disposal.

While recycling municipal discards has enormous potential, it is also important to note that some products and materials – for example, mercury thermometers and PVC plastics – are so polluting in their production, use and disposal that recycling is not appropriate. In these cases, recycling may actually perpetuate the use of a toxic material and a better solution is to design the waste out of the system through material substitution.

Manufacturing enterprises using recycled feedstocks ideally should be located in proximity to material sources. While trade in recovered materials as feedstocks is common worldwide, industrializing nations typically would benefit most from domestic processing, as opposed to exporting raw materials and importing finished products.

Development of micro-enterprises has often been successful in supporting local manufacturing capabilities. Support agencies can provide small amounts of capital and technical assistance to budding enterprises. The Payatas Micro-enterprise Promotion program (Barangay Payatas, Manila, the Philippines) is an innovative example of micro-enterprise development in an industrializing nation. This program was one element of a larger project, the Payatas Environmental Development Program, which focused on bettering conditions for the poorest 20% of the community. The Micro-enterprise Promotion program provided financial services (including internally-generated credit and savings facilities), enterprise development, business consultancy, and other extension services tailored especially for micro-enterprises engaged in the collection, recycling, and reuse of recovered materials. The program created a "Handmade Paper Recycling Project" where participants are trained in the rudiments of a micro-enterprise management, from production and financing to marketing.[76]

Brazil is one country in the global South leading the way in recycling-based economic development. The country is home to numerous enterprises — which have only been in existence for an average of three to seven years — that produce remanufactured goods. Brazilian recycled products are competing on the market with similar goods made from unused materials. Here are some examples of recycled products these companies produce:

- Bathroom shower stall, the Ecobox, made of recycled aluminum for the framework trim and reprocessed plastics for the door and sides partitions.
- Door mats for houses and businesses, made of vegetable fibers.
- Ceramic blocks for covering walls made of clay and paper residue.
- Roof insulation sheets from Tetra Pak milk and juice packaging.
- Thermal-acoustic insulation from wastepaper and other recycled materials.
- Notebooks made from wastepaper (with sugarcane waste covers).
- Textile fiber, Alya Eco, made from 100% reprocessed PET plastics.
- Flooring and sneaker soles made from recycled tires.
- Decorative glass objects from recycled glass.[77]

Much can be accomplished with relatively low levels of capital investment.

In Egypt, the number and breadth of recycling industries in the informal sector has soared during the last few years. Mokattam, a settlement outside of Cairo that handles one-third of Cairo's household discards, is a good example. From 1996 to 2000, the number of small-scale recycling enterprises (or recycling workshops) in Mokattam

increased by 29% to 228. The total invested in these enterprises is LE 3,080,650 (~US$727,000), of which LE 1,805,350 (~US$426,000) covers equipment.[78] Table 10 shows the type and number of recycling industries in the settlement.

Mokattam's recycling workshops often represent self-start-up micro-entrepreneurs who use locally designed and manufactured technology available in the informal sector of Egypt's economy. Such enterprises, which required negligible start-up capital, include:

- manufacturers of cotton stuffing for mattresses, pillows, and the like; and
- plastics manufacturers that produce clothes hangers, pitchers, ice cream spoons, lollipop sticks, and other products.[79]

Table 10: Number and type of recycling industries, Mokattam, Egypt

Type	1996	2000
Plastic crushing machines	44	65
Washing & sorting plastics	8	6
Plastics granulation	6	15
Cloth grinders	16	17
Paper compactors	15	19
Cutting tin	11	29
Washing tin	2	2
Pelletizing machines	6	11
Other plastics	8	7
Injection molding	27	44
Aluminum smelters	20	13
Total	**163**	**228**

Source: *The Informal Solid Waste Sector in Egypt: Prospects for Formalization* (Cairo: Community and Institutional Development, January 2001), p. 36.

Recycling-based industries have the following advantages over incineration. They:

- sustain more jobs,
- reduce demand for raw materials,
- save energy (for example in raw materials mining and processing),
- need lower capitalization costs,
- involve easier entry for small, local firms,
- present fewer problems with monopolies,
- keep investment local rather than flowing to foreign firms, and
- pollute less.

Educational programs

Educational efforts need to precede any waste reduction program introduction. These efforts should inform residents, businesses, and discard management workers about the need for the new system and how it will operate.

Past experience with source-separated collection in Manila highlights the need for this education. In 1999 the Metro Manila Development Authority suspended implementation of source-separated collection requirements to allow more time for information dissemination and training. A pilot source-separation collection program revealed a low rate of compliance, caused by confusion about the regulation.

Waste reduction educational efforts in schools can reap long-term and far-reaching benefits. School children can strongly influence the behavior of their entire family. Furthermore, if educational efforts in schools are complemented by implementation of school waste reduction programs, schools can save money on waste disposal.

Examples of educational resources and education programs that could serve as models for replication in other industrializing nations include:

- Puerto Princesa City's (the Philippines), Oplan Linis (Operation Cleanliness) Program uses citizen volunteers to create a sense of urgency, concern, and responsibility for the cleanliness of the community. The program focuses on value formation through massive information and education campaigns to instill in the minds of the people, especially the children, the importance of a clean environment. Since the program's inception in 1992, the city has significantly reduced litter and outbreaks of contagious diseases.

- Metro Manila (the Philippines) Council of Women Balikatan Movement, Inc. has created an education program targeting school children. In order to inform the schools, the Council organized seminars for almost 1,500 school principals and supervisors in 25 strategically located schools in the 17 cities and towns and distributed flyers there. The Movement also helped establish model schools where children convert food discards into compost for use in the school gardens and for sale to prospective buyers.

- Bustos, Bulacan's (the Philippines) Local Health Board conducted an outreach and education program to support an ecologically-sound waste management system. The Board coordinated activities with local women's organizations, nongovernmental organizations, and other civic and religious groups. The program enlisted small groups of residents who worked to motivate other community members to join in the waste reduction programs. Started in 1993 this program has improved the sanitation of the entire municipality.

- The Association of Youth for a Better India (AYBI), in Mumbai, India (formerly Bombay), began spreading the concept of source-separation of discards in the city in 1992. In 1994, it launched project YES (Your Environmental Standards), to make presentations about source-separation to residential societies and other interested groups. In 1999, the group launched a poster exhibition series in area schools and colleges about the problems of garbage disposal and offered solutions. In addition to the poster exhibition, AYBI offers students brochures with the relevant information. The project targets youth because, according to Ritika Asrani, the project coordinator, "We believe that it is very important to prepare the youngsters of today with the consciousness that it is their effort that will make a difference, so that they become active citizens for the future."[80]

- In 1994 the Association for the Protection of the Environment (APE) in Cairo, Egypt, piloted a source-separation scheme in two Cairo neighborhoods. Sixty-five percent of residents complied for two years. The results of the pilot were used to transfer the experiment to Nuweiba, South Sinai, where now 90% of the town is source-separating their discards into organics and non-organics, through a non-governmental organization called Hemaya ("Protection" in Arabic). In 2000, APE launched a public awareness community-based campaign in 250 neighborhoods and 65 schools in the greater Cairo area. The result was 100% unanimous response to acceptance of the idea and willingness to participate.[81]

Policy options to support waste prevention and materials recovery

As governments around the world struggle with waste management, many new policies have been developed to support waste reduction, reuse, recycling, and composting. Policies that may be transferable to industrializing nations include "extended producer responsibility," pay-as-you-throw pricing, bans on non-reusable and/or non-recyclable materials, and market development and support programs.

Extended producer responsibility (EPR), based on the "polluter pays" principle, entails holding manufacturers responsible for the entire lifecycle of the products and packaging they produce. Principal aims of EPR policies are to internalize the environmental costs of products into their price and to shift the economic and/or physical burden of managing products that have reached the end of their useful life from local government and taxpayers to product producers and consumers. Examples of EPR initiatives include deposit-refund systems, product take-back programs, product fees and taxes, and product design requirements. EPR will encourage manufacturers to make products more durable and more recyclable, and with fewer resources.

Deposit-refund systems are perhaps the oldest example of an EPR policy. In a deposit-refund system, refundable fees paid by consumers help ensure return of products at the end of their lives. The most familiar deposit-refund systems are "bottle bills." In the ten U.S. states with bottle bills, the laws require beverage retailers to pay consumers a specified refund value for returning empty containers, and require wholesale distributors of the beverages to pay refunds to retailers. Recycling rates for beer and soft drink containers in the ten bottle bill states average 80%, twice the rate in non-bottle bill states. Private industry in Thailand has voluntarily implemented deposit-return systems for some soft drink and water containers. Each refilled bottle in Thailand is used an average of 44 times during its lifecycle, significantly reducing waste. Refillable bottle systems for beer and soft drinks are common in industrializing countries. The concept, perhaps, could be expanded to other glass food and beverage containers.

Product take-back programs require that manufacturers assume physical and/or financial responsibility for products and/or packaging at the end of their useful lives. For example, the state of Rio de Janeiro, Brazil, has enacted a plastic packaging takeback law. Under this law, importers must guarantee packaging takeback, and must also devote a portion of their advertising budget to anti-litter or recycling education. In mid-2001, the Brazilian national legislature was working on a tougher law for the whole country.[82]

Fees and taxes can encourage product reuse and recycling. These assessments, sometimes referred to as "eco-taxes" or "eco-fees," can be charged to either manufacturers or consumers. For example, Taiwan established a fee system for non-PET containers, used tires, used cars and motorcycles, lubricant oils, batteries, televisions, air conditioners, refrigerators, washing machines, and computers and computer accessories. Industry and importers must pay fees based on their sales of the covered products. The fees are then used to support recovery systems.

Design criteria ensure products or packaging are designed to reduce environmental impact. For example, South Korea has passed a comprehensive set of design criteria defining allowable empty space ratios in packaging and limiting the number of layers of packaging for specific product categories. Design criteria can be used to reduce both the volume and toxicity of materials used in products and packaging.

"Pay-as-you-throw" (also known as unit pricing or variable-rate pricing) refers to a fee structure in which customers pay for collection and disposal of municipal discards based on the amount of discards generated. Pay-as-you-throw systems create a direct economic incentive to generate less waste and, when offered in combination with a free or cheaper opportunity for recycling, encourage waste generators to do so.

Without adequate enforcement, pay-as-you-throw systems may not work for residential customers in industrializing countries. Lack of enforcement could force some individuals to burn their discards or to dump them in roadways, waterways, and public areas in order to avoid fees – adding to an already significant uncollected waste problem in many countries. A system in which residents are allowed to generate a base amount of trash before incurring per-bag or per-can fees may be one viable option. Businesses in industrializing countries often have to pay for trash collection and, sometimes, disposal. This provides an opportunity for implementation of pay-as-you-throw pricing.

In the past, the discard stream in industrializing nations was comprised predominantly of food discards, animal wastes, and ashes (from cooking and heating). Today the proliferation of disposable packaging and single-use products has radically altered the composition of discards. Many of these items are not compostable or recyclable. In order to prevent disposable items from filling disposal facilities, some jurisdictions have banned non-reusable, non-recyclable materials. For example, in 2000, Shanghai banned disposable chopsticks and polystyrene lunch boxes in main downtown restaurants and snack stores.[83] Seoul, South Korea,

also has a ban on disposable chopsticks and throw-away food containers.

Several Indian states have initiated campaigns against plastic bags. Citing the impact on the environment of the widespread use of plastic carrybags,[84] the government of West Bengal, for instance, is phasing in a ban on plastic bags. Effective September 15, 2001, the use of plastic carrybags – regardless of thickness — are banned in ecologically sensitive zones (hilly areas of Darjeeling district, entire Sundarban areas, and coastal zone areas). Beginning December 1, 2001, all plastic carrybags less than 20 microns thick are banned from the state. Goa, Himachal Pradesh, Sikkim, Meghalaya and Tamil Nadu have made similar decisions.[85]

The Tamil Nadu Pollution Control Board is considering more extensive plastics regulations. Proposed legislation calls for the ban of disposable plastics (such as those used in food packaging, plastic cups, plates, and carrybags). It also calls for manufacturers to pay for the collection, transportation, and recycling of plastic mineral water bottles and water sachets.[86] Three corporations, 63 municipalities, and 40 town panchayats (village councils) in the state have passed resolutions banning the use of throw-away plastics. The Board has asked government departments and nongovernmental organizations to study biodegradable alternatives to plastics. It has spent Rs 50 lakhs (~US$104,000) on bus advertisements, Rs 1.5 lakhs (~US$3,100) on an alternatives to plastics exhibition, and has approved Rs 1 lakh (~US$2,100) for each district collector for a campaign program, "Children Against Plastics."[87] (A lakh is 100,000 Rs.) The Board's proposed legislation has precedents elsewhere – a number of jurisdictions around the globe have laws restricting plastics. Berkeley, California, U.S., for instance, prohibits the use of polystyrene foam food packaging by restaurants, takeout food vendors, and by the city.

Government can play a critical role in support of waste reduction, particularly through support for business and industry using recovered materials as feedstock and support of the markets for products manufactured from recovered materials and compost. Brazil is setting an example for many other nations in how government policy and programs can help achieve waste reduction. Examples include:

- In 2000, the Brazilian government changed a taxation policy that penalized recycled plastics compared to virgin resin. Prior to passing the legislation, the federal tax applied to industrialized products on recycled plastics was 12% compared to 10% for virgin resin. The new rate of taxation for recycled plastics is 5%.[88]

- The Brazilian Environment Ministry offers funding to local governments to support integrated solid waste management programs. In 2001, the Ministry planned to provide funding of approximately fifteen million reals (US$5.9 million) to support waste management projects with social emphasis.[89]

- Numerous state governments in Brazil have established waste exchanges to help businesses and industries reduce disposal. For example, the Minas Gerais state Waste Exchange Market, set up by the state's Center for Industry (CICI-MG) in 1993, tries to match up companies that have unwanted raw materials with potential users. It also advises businesses on how to correctly dispose of their industrial discards by recycling, reuse, and minimizing the production of waste. A company using the system offers or requests materials, giving information on quantity, characteristics, potential uses and means of negotiation (donation, sale, purchase or exchange) without having to identify itself. According to Leonídio Soares, vice-president of CICI-MG, the waste exchange's greatest contribution is in mobilizing companies to invest in the management of their discards, minimizing waste production, practicing reuse or recycling, and encouraging the development of new technologies.[90]

Policies that encourage wasting over prevention and diversion should be eliminated. These would include any subsidies for waste incineration, especially those that are not offered for prevention, diversion, reuse, recycling, or composting. In India, for example, the Ministry of Non-Conventional Energy Sources provided subsidies up to US$1 million for a 5 kW waste incineration facility to handle 500 tonnes per day of waste. On the other hand, a centralized composting plant in Delhi cost less than US$0.5 million for the same amount of material but was offered no subsidy. That plant is finding it difficult to sell its compost as compost has to compete against chemical fertilizers, which are also subsidized.[91]

Discards management without incineration

Incineration is an inappropriate method to handle discarded materials in any country. Yet, industrializing countries have perhaps more reasons to avoid it. The typical discard stream in these countries is composed of a large proportion of recyclable and compostable materials. Once these materials are removed, a substantial portion of the remaining materials contain little or no value as fuel. For example, the discard stream in Delhi, India, consists of 11.8%, by weight, of paper, metals, glass, textiles, and plastics, materials which are largely recyclable (see Table 11). A further 57.7% is organic and, therefore, compostable. Nearly 23% of the material is non-incinerable ash and dust. The final category of materials, which comprises 7.5%, includes bones, stones, and wooden matter. While the wood is certainly incinerable, few would try to burn bones and stones. In communities that similarly discard materials with such high organic content, composting could achieve at least a 50% waste reduction.

Implementing alternatives before landfills overflow

Incineration falsely appears to offer a quick-fix solution to near-capacity landfills. In reality, it cannot be implemented quickly. Lead time for design, siting, and construction can take many years. For example, an incineration company official estimated the timeframe for a proposed incinerator in the Republic of Ireland to be three to five years.[92] Citizen opposition can delay projects for many more. In contrast, a neighborhood participating in the Advanced Locality Management program in Sahar, Andheri, Mumbai (formerly Bombay), India, reduced their garbage disposal by half within two years.[93]

Sustaining and expanding jobs through reuse, recycling, and composting

Recycling is an economic development tool as well as an environmental tool. Reuse, recycling, and composting offer direct development opportunities for communities. When collected with skill and care, and upgraded with quality in mind, discarded materials are a local resource that can contribute to local revenue, job creation, business expansion, and the local economic base.

Table 11: Composition of urban solid waste in Indian cities

City	Paper	Metals	Glass	Textiles	Plastics*	Ash & dust	Organics	Other**
Madras	5.90	0.70	--	7.07	–	16.35	56.24	13.74
Delhi	5.88	0.59	0.31	3.56	1.46	22.95	57.71	7.52
Calcutta	0.14	0.66	0.24	0.28	1.54	33.58	46.58	16.98
Bangalore	1.50	0.10	0.20	3.10	0.90	12.00	75.00	7.20
Ahmedabad	5.15	0.80	0.93	4.08	0.69	29.01	48.95	10.39
Bombay	3.20	0.13	0.52	3.26	–	15.45	59.37	18.07

* includes rubber and leather
** includes bones, stones and wooden matter
Source: Planning Commission on "Urban Solid Waste Management in India," GOI (1995).

In the U.S., on a per-tonne basis, sorting and processing recyclables alone sustain 11 times more jobs than landfilling or incineration.[94] However, making new products from the old offers the largest economic pay-off in the recycling loop. New recycling-based manufacturers employ even more people and at higher wages than does sorting recyclables. Some recycling-based paper mills and plastic product manufacturers, for instance, employ on a per-tonne basis 60 times more workers than do landfills.

Value is added to discarded materials as a result of cleaning, sorting, and baling. Manufacturing with locally collected discards adds even more value by producing finished goods. For example, in the U.S., old newspapers may sell for US$30 per tonne, but new newsprint sells for US$700 per tonne. Each recycling step a community takes locally means more jobs, more business expenditures on supplies and services, and more money circulating in the local economy through spending and tax payments.[95]

Latin American waste management and the movement towards extended producer responsibility (EPR)

In the last ten years, waste management has become a major issue in many Latin America countries. Before the 1990s, per capita generation of waste was low compared to generation in industrialized nations and much of the waste had a high organic content. Today, per capita generation rates in some Latin American countries are nearly twice what they were in the early 1990s and the discarded materials have a much higher non-biodegradable content.

Many of the existing disposal sites in Latin America are little more than controlled dumps which have polluted nearby water resources. As governments in the region have sought to create new sanitary landfills, they have faced opposition from local residents and environmental groups. As a result, Latin America is running out of places to put its garbage and most governments do not have the resources to develop new disposal facilities.

Most Latin American governments do not consider incineration a viable alternative for municipal solid waste management. Many of the countries cannot afford the high capital and operating costs for state-of-the-art incinerators. Furthermore, the waste stream in many Latin American countries is too wet to burn efficiently because of high humidity and the high percentage of materials, such as food waste, which have a low calorific value. Finally, many of Latin America's mega-cities are struggling with air pollution problems. Incinerators, which would add to these problems, are not acceptable to the populace.

In response to their waste management dilemmas, many Latin American countries are planning and introducing programs and policies to encourage recycling. These programs are as varied as the countries themselves, including mandatory and voluntary efforts, deposit refund systems, take-back requirements, special taxes, and minimum recycled content requirements. Many of the existing and proposed programs incorporate the principles of extended producer responsibility which transfers some or all of the physical or financial responsibility for end-of-life products and packaging back to the producers.

Examples of existing and proposed EPR policies in Latin America include:

- Uruguay's voluntary covenant for the "integrated management of non-returnable plastic packaging." This agreement was signed on August 16, 1999. Parties to the agreement include the government's Housing and Interior Ministry (MVOTMA), the Chambers of Industry of Uruguay, the Uruguayan Association of the Plastics Industries, the Center for Manufacturers of Non-alcoholic Beverages, Waters and Beers, and the three major beverage bottlers in the country. Under the covenant, the beverage and recycling industries share responsibility and costs for the collection and recycling of containers and have committed to reaching the following recovery targets:

2001:	10%	2004:	35%
2002:	25%	2005:	40%
2003:	30%		

- The Brazilian National Environment Council's (CONAMA) proposed National Waste Policy which states that one of its fundamental principles is "the post-consumer responsibility of the manufacturer/importer for their products and respective packaging offered to the final consumer." This responsibility would include the creation of redemption centers where consumers could return end-of-life products and packaging, and development of systems for recycling and/or disposal of the products, as applicable.

- CONAMA (Brazil) implemented the world's first EPR system for tires. Under their resolution 258/99, tire companies must recycle or arrange for the energy recovery of one scrap tire per every four new tire sales. The ratio of required recycling rises every year until 2005, when companies must appropriately handle one scrap tire for every new one they sell. [*Note: GAIA has concerns about tire incineration and does not recommend burning tires to recover energy.*]

- Rio de Janeiro state's mandatory packaging take-back law, passed in 2000. The law requires the take-back of all plastic packaging and its subsequent reuse or recycling.

- The Mexican Green Party's proposed bill to create a National Solid Waste Law. The proposed law would require the creation of EPR systems for packaging wastes, construction and demolition materials, used tires, distributors of imported products must set up take-back systems for their packaging by July 21, 2003.

- Under Argentina's December 1991 Law 24.051 on hazardous waste, the government passed a resolution requiring businesses selling lead-acid batteries to take back used ones and send them to licensed treatment plants. So far compliance with the resolution has been poor.

The economic pressures faced by Latin American governments make it likely that EPR programs, which shift waste management costs from governments to corporations, will continue to be an integral part of Latin American waste management policy in the future.

	General packaging	Plastic packaging	Batteries	Used oil and lubricants	Electrical and electronic equipment	Construction and demolition materials	Fluorescent lamps	Household toxics
Argentina	NP	NP	NE, NP, LP	NP	NP		NP	
Brazil	NP	NP, LE, LP	NE, LE, LP	NE	NP, LE, LP	NP, LE, LP	NP, LE , LP	NP, LE, LP
Chile	NE	NE	NP			NE		
Colombia	NP	NP	NP, LP	LE, LP		NE		
Ecuador				NE, LP				
Mexico	NP, LP	NP, LP	NP	NP		NP	NP	
Peru	NE	NE						NE
Uruguay	NP (beverage containers only)	NE, NP	NE					

Note: Lack of designation indicates ILSR was not aware of any related policies or laws at the time this report was written. The noted existence of a law, resolution, or policy in effect does not necessarily translate into an effective program.
NE = National law , resolution, or policy in effect
NP = National bill, regulation, or policy drafted or proposed
LE = State or local laws, resolutions, or policies in effect
LP = State or local bills, regulations, or policies drafted or proposed

Source: Keith E. Ripley, *Recycling and Solid Waste Policy in Latin America and the Caribbean*, Raymond Communications Inc., College Park, Maryland, U.S., 2002.

Improving the livelihood of wastepickers and others in the informal sector

Poverty and scarcity of resources drove the creation of informal recycling systems long before recycling became mainstream in the west. For example, separation of bottles and newspapers at the household level for sale to vendors has been a feature of South Asian life for decades. Throughout industrializing nations, collectors, wastepickers, and scavengers remove materials from curbside trash containers, community bins, and at disposal sites. Most of these systems operate at no cost to waste management authorities while substantially reducing their disposal costs.

Millions of people in the global South live and work as landfill scavengers and wastepickers. For example, wastepickers, waste buyers, waste dealers and wholesalers, and small recycling enterprises account for an estimated 1-2% of the workforce in large cities in India.[96] Without these small armies of mostly women and children, cities would be dirtier and the quality of the urban environment would be much lower. Yet, workers get no wages, no benefits, and, needless to say, no respect. They are subject to a number of health hazards as a result of handling decomposing garbage and toxic materials with their bare hands. Common ailments found among scavenger populations include turberculosis, scabies, asthma, respiratory infections, cuts, injuries, and animal bites from pigs, dogs, cows, and rodents.[97] Furthermore, they rarely receive police protection and organized crime elements freely expropriate hard-won surpluses.

Remarkably, within the dumps, people struggle and succeed to create community. The landfill dwellers carve out streets, build homes and schools, and start small businesses. Many landfill wastepickers maintain an entrepreneurial spirit. They create informal landfill-based enterprises and strive to become part of the mainstream economy. They generate surpluses and invest their capital. Wastepickers at many landfills have formed cooperatives where cooperation extends beyond the enterprise to shelter, childcare, food gathering, and protection.[98]

If wastepickers were fairly compensated for their labor, protected from health hazards, and the stranglehold of criminal elements removed, small businesses would flourish. (In Pune, India, for example, wastepickers salvage about 200 tonnes of recyclable scrap saving the local municipality about Rs 60,000 (~US$1,250) per day. This translates to each wastepicker contributing Rs 2,400 (~US$50) worth of unpaid labor per year to the municipality.)[99] In Delhi, wastepickers save the municipality a minimum of approximately Rs. 600,000 (~US$12,500) daily through their labor alone. Their labor also adds value to the materials. Trading plastics, prior to reprocessing, for example, increases its value by 700%.[100] Investment in equipment and trucks could increase efficiency and productivity. The scavengers could join the formal economy. If wastepicker enterprises were formalized and entered the tax rolls, the infrastructure for adequate shelter and community (roads, schools, clinics, and recreation areas) could be afforded, as well.

Essential investments in worker productivity include equipment such as boots, gloves, basic hand tools, conveyor belts that allow workers to sort through materials without constant stopping and bending, and vehicles which give enterprises the ability to move materials to markets. Establishment of local enterprises could allow the landfill dwellers to add value to recovered materials. For example, workers could clean and sanitize glass bottles for use in plants adjacent to the landfill. Through vermicomposting—the use of worms to hasten the composting process—landfill dwellers could produce quality topsoil and marketable crops of worms.[101]

New relationships can emerge between wastepickers and their cities. Prior to the 1949 Communist Revolution in China, Shanghai's scavengers were among the most downtrodden in the world. Within five years, however, these scavengers evolved into industrial leaders. Their efforts to build the Shanghai Resource Recovery Company with its matrix of collection, processing, and manufacturing earned them the highest praise from their municipality.[102]

Community-based projects in India help wastepickers

Srishti is a nonprofit research, technical assistance, and advocacy organization based in Delhi, India. It works on environmental issues related to waste management, ragpickers, recycling, and medical wastes. It focuses on helping communities and institutions solve their problems using local resources. Srishti has implemented several community-based recycling and composting projects that incorporate the informal sector. It has trained ragpickers to collect garbage from residents and to compost biodegradable waste. Some of these projects include:

- Using vermicomposting to convert kitchen scraps into worm castings in a Delhi Development Authority residential neighborhood in Munirka.
- Designing a waste management system that employs ragpickers and manages wastes from offices and households. The kitchen scraps are pit-composted.
- Installing a vermicomposting project at the All India Institute of Medical Science to manage more than 140 kg of waste per day.
- Putting in place a waste management system at Malcha Marg, which employs ragpickers.
- Starting a waste management system in Anand Niketan using local sweepers and a ragpicker to vermicompost the waste.

Another Indian organization, Chintan, works primarily in Delhi on issues related to sustainable and equitable consumption. It works both at the grassroots level with the city's poorest wastepickers, communities and institutions generating waste, as well as with policy makers. Chintan builds the capacity of wastepickers by providing training in waste handling and composting in order to make their work both safer and economically viable. It also works with wastepickers on other issues including police harassment, access to medical facilities, right to work and recognition and inclusion in planning processes. Some ongoing projects include:

- Waste handling in Dilli Haat, a popular food and crafts Bazaar in the heart of Delhi run by Delhi Tourism. The project includes training cooks and assistants to segregate waste, training wastepickers to pick up waste, composting food and other waste, reducing the use of plastics, public awareness and sweeping. The site is also used to train wastepickers for other projects.
- Waste handling for a chain of luxury hotels in Delhi, where recyclers have created an informal enterprise that buys recyclables while also increasing segregation through a system of information sharing with the managers. This helps waste recyclers to build diverse skills.
- Recycling in a slum where the local nongovernmental organization is now trained to carry out waste segregation, collection and composting with encouragement on households from the local children.
- The New Delhi Railway Station is one of the most crowded and well known Railway Stations in India. Here, Chintan trains wastepickers to carry out their work more safely. Chintan supports the wastepickers to organize themselves with Identity Cards, work with cleaners from the railways to access better equipment, train contractors and others to stop burning waste, train staff on the trains to dispose of their waste and increase public awareness through an innovative system of positive tickets administered by the cleaners themselves.
- Chintan promotes waste recycling in economically diverse areas of Delhi. It teaches residents to compost waste in small household composters developed by Chintan to fit into small flats. This succeeds in reducing the waste as well as reducing the dependency on erratic municipal services while developing a high level of ease with managing discards safely at home.

Source:

Ravi Agarwal, Srishti/Toxic Link, New Delhi, India, personal communication, June 2001.

Bharati Chaturvedi, New Delhi, India, personal communication, June 2003.

On a micro level, similar achievements have been realized. In São Paolo, Brazil, corporate investment in local scavenger operations has had dramatic results. By providing tools and carts, scavengers have been transformed into local merchants. They are accepted and respected within their communities.[103] More recently, the Brazilian Ministry of the Environment's National Fund for the Environment is funding buildings and equipment for wastepicker cooperatives. The fund is available to local governments with populations between 20,000 and 100,000. In 2001, the ceiling for each project funded is BRL$550,000 (~US$198,000) and the prospectus has a strong social emphasis. City governments have been requesting funding to build warehouses to house recycling cooperatives of scavengers, including the purchase of essential equipment such as compactors. The Ministry wants to see applicants include in their social plans the insertion of street scavengers (catadores) families, or of scavengers and their carts on public highways, or include the social rehabilitation of children and adolescents, providing means for them to attend school.[104]

Pune, India, provides one successful model of improving the livelihood of wastepickers through recycling and composting. In 1993, 5,000 adult wastepickers and "itinerant buyers" (who purchase scrap from residential areas and commercial establishments) were organized into the Kagad Kach Patra Kashtakari Panchayat, in order to establish a collective identity and provide leverage for bargaining. To establish their status as "workers," the association was registered as a trade union and members were issued photo-identity membership cards. The Pune and Pimpri Chinchwad Municipal Corporations officially endorsed the identity cards in 1996 and 1997, respectively. The endorsement was important because it authorizes adult scrap collectors to collect recyclable scrap. Next the authorized wastepickers started collecting segregated organic and recyclable materials at the source through doorstep collection. The Pune and Pimpri Chinchwad municipalities promoted public awareness of the segregation system. Wastepickers retain the scrap and deposit the organic materials in the public bin or vermiculture pit, using trolleys provided by the municipality. They sell the scrap to scrap traders by weight after rudimentary sorting into about 13 broad categories of plastics, glass, white paper, mixed paper, milk bags, tin, and iron. (Material is further sorted and graded as it moves progessively through various trade channels till it reaches the reprocessor or end users.) Residents are required to pay the wastepickers a service charge of Rs 10 (US$0.20) per month per household for the collection service. Each wastepicker is allotted about 100 households. As of October 2000, the scheme covered 25,000 households and commercial establishments, benefiting about 300 wastepickers.[105]

The Kagad Kach Patra Kashtakari Panchayat is also addressing the need to develop social security for wastepickers. The Scrap Collectors Association along with the Life Insurance Corporation of India have recently introduced a group insurance plan for its members. For an annual payment of Rs 25 (US$1.25), members receive insurance coverage of Rs 5,000 (US$250) (death due to natural causes) and Rs 25,000 (US$500) (accidental death), or proportion thereof in case of disability. In addition, in 1997, the Kagad Kach Patra Nagri Sahakari Pat Sanstha, a savings linked credit cooperative, was formally registered. Members deposit a fixed amount as savings every month. It entitles them to credit of up to five times the amount saved at an 18% per annum interest rate. A surcharge of 6% per annum is levied towards a social security fund.[106]

In Eygpt, thousands of people make a living from discards. This informal sector — consisting of informal collectors, scavengers, sorters, street "roamers," traders, and processors — is responsible for recovering 124,800 tonnes per year of Cairo's municipal discards and has created a giant industry. These people have invested large amounts of money, time, and labor. They have invested in building homes for themselves. They have invested in trucks and other tools of their trade. They have invested in machines for their recycling workshops and industries. They have spent considerable time and effort developing markets for

materials, in both the formal and informal sectors. Their linkages with other local and national markets have made them critical to certain industries. Changes or interventions at any point in this complex web of activities and trading relations will have repercussions on the whole system and the flow of products. Upgrading the trade of garbage collection is necessary (sorting, for example, exposes workers to numerous health hazards). In Egypt as in other parts of the global South, including the informal sector is absolutely critical to any changes and improvements in the solid waste system.[107]

A recent report detailing the informal solid waste sector in Egypt recommends in part:

"A new vision which integrates urban upgrading of informal sector communities needs to be developed. One where residents can remain in their

Street scavenger association in Belo Horizonte, Brazil, brings benefits to the community and the informal sector

Belo Horizonte, located in the south east region of Brazil, is Brazil's third largest city. The city has had a scavenger population for more than 50 years. Traditionally, life was very difficult for the wastepickers. Brokers lent pushcarts to wastepickers, who were then forced to sell their goods to them. The scavengers often believed the brokers cheated them by use of scales that under-weighed recyclables. In response, scavengers often wet paper and cardboard to increase their weight.

While some of the scavengers established agreements with businesses to collect recyclables on a regular basis, many scavengers obtained their materials from trash bags left on the curb. Regardless of the source of materials, most of the scavengers sorted them in the streets, resulting in the scattering of litter. Many slept on the streets because they could not leave their materials unattended. As a result, other citizens often viewed the scavengers as "part of the rubbish." Periodically, the scavengers were expelled from the streets in beautification efforts. Since the government did not formally recognize waste picking as a profession, the scavengers had few rights or social security.

In 1988, *Pastoral de Rua* (the Street Pastoral Team — a group from the Catholic Church that works with street dwellers) began working with the scavengers to improve their circumstances. This work led to the creation in 1990 of the Street Scavengers' Association (ASMARE). ASMARE demanded the scavengers have the right to work in the city collecting recyclables, and asked the city to provide a proper place for the sorting of their material.

In 1993, the Belo Horizonte Superintendency of Public Cleansing (*Supervision of Limpeza Urbana* or SLU in Portuguese) implemented a source separation system designed to assist the scavengers. By 1999, the SLU had placed nearly 400 containers for recyclables around the city for the source-separated collection of plastics, tin cans, paper, and cardboard. Between 1994 and 1996 the city constructed one warehouse where ASMARE members prepare recyclables for market and rented two others. SLU staff collect materials from the public containers and transport them to the ASMARE warehouses for processing. ASMARE members also collect recyclable materials from commercial establishments in Belo Horizonte.

Membership in ASMARE has grown from 31 scavengers in 1993 to more than 250 in 2000. The organization benefits around 1000 people including associates' families. ASMARE´s output has increased from an average of 15 tonnes per month to 500 tonnes, and the program results in nearly US$30,000 in annual savings for the city in landfill-associated costs. ASMARE associates receive compensation based on their production and market prices. As of May 1998, 54% earn the equivalent of twice the minimum wage, 40% from two to four times the minimum wage, and 6% earn more than five times the minimum wage.

As ASMARE matures, the organization is branching out into other efforts to provide new employment opportunities for its members. These efforts include a restaurant, the "Cookery Workshop," a Recycling Paper Workshop (for the production of note-pads and other recycled stationery), and a Sewing Workshop.

Sources: Heather Kepran and Jennifer Lee, "Municipal Administration of Belo Horizonte, Brazil: Waste Management through Community Partnerships," International Council for Local Environmental Initiatives, Toronto, Canada, March 2001.
Sonia Maria Dias, "Integrating Waste Pickers for Sustainable Recycling," a presentation at Planning for Sustainable and Integrated Solid Waste Management, Manila, the Philippines, September 18-21, 2000.

neighborhoods and be left to practice their trade but where infrastructure and neighborhood upgrading really takes place. A plan where micro-enterprise workshops are upgraded and new appropriate technology inputs convert people from negative practices to better ones. A plan that will reap the benefits of cumulative experience of community-based organizations and grass roots development interventions. A plan that will formalize the informal sector into formal sector companies, with attendant learning and technology upgrading." [108]

Unfortunately, the new national trend in Egypt is to invite the formal private sector to manage municipal discards. This risks replacing the efficient informal sector's door-to-door service with large-scale, inappropriate technologies.

The report cited above concludes:

"Given the magnitude of [the informal] sector, its employment generation potential and its safety net features for unskilled and semi-skilled workers, we feel it is imperative to incorporate the informal sector in the competitive bidding process in the new, proposed system. It would be a great loss to the sector if Cairo were to lose their valuable expertise – built over four decades in the capital." [109]

Where there is civilization, there is scavenging and an informal recycling sector. But the conditions of scavenging and other informal sector trades, and the economic and social relations between these essential industrial workers and their society at large, do not have to be exploitative and inhumane, nor should they be overlooked. They can be cooperative and sustainable. Much can be done to improve the livelihoods of those working in the informal sector. Before making changes to discard management systems, decision and policy makers should have an in-depth understanding of the complex web of relations and interactions that exist between the formal and informal recycling sectors in the global South.

Aiming for zero waste:

ten steps to get started at the local level

Every community is different. There is no one way to prevent, reduce, reuse, recycle, or compost discarded materials. For instance, manual sorting of recyclables may be appropriate in one community and not in another. The ten steps listed below are applicable to most if not all communities interested in pursuing a zero waste future. A community group or local government can take any step to get started. These steps are not mutually exclusive. Integrating community participation in decision-making will enhance the success of any discard management program. This plan can be adopted at the community, municipal, or national level, depending on which approach will yield the best results in each situation. Also, one can work with many communities to adopt local zero waste goals, and the momentum generated can lead towards an eventual citywide or even national goal.

1. Adopt a non-incineration discard management plan. Better yet call it a resource management plan and embrace zero waste as a vision for the future. Make waste prevention, reuse, repair, recycling, and composting the heart of the plan. Adopt waste elimination goals as well as recycling goals. Provide leadership, dialogue, and information on how to move toward a zero waste economy. Decide against privatizing and centralizing waste systems. Seek public input to build broad public support for waste reduction programs and build a network of stakeholders to be involved in the design and implementation of the programs. Make community participation meaningful.

2. Decentralize waste management by building on local community initiatives using local resources and accommodating the informal sector. Community projects do not need to be relegated to local small efforts. Replicate and expand successful community initiatives. Provide them with an institutional structure that will allow them to thrive and become mainstream (for example, earmark land for composting activities). Allow for decentralized functioning and community efforts rather than an emphasis on one central initiative to solve all waste problems.

3. Target a wide range of materials for reuse, recycling, and composting (especially several grades of paper and all types of organics) and **keep these materials segregated** at the source from mixed trash to maintain quality and enhance diversion levels.

4. Compost. Composting is key to achieving 50% and higher diversion levels and doing so cost-effectively. Keeping organics and putrescibles out of landfills will make landfills less of a nuisance and source of pollution. Emphasize backyard or at-home composting followed by community composting. Target many types of clean organic materials and offer year-round, frequent, and convenient collection.

5. Make program participation convenient and meaningful. The more households and businesses participating, the more materials diverted from disposal. More people will reduce, reuse, recycle, and compost if programs are convenient, easy, and simple. Some ways to make programs convenient include:

- providing curbside or door-to-door collection of recyclables with the same frequency curbside collection of trash is provided;
- providing seasonal and frequent collection of yard trimmings;
- offering service to all households including multi-family dwellings;
- utilizing set-out and collection methods that encourage resident participation as well as yield high-quality, readily marketable materials (such as using large bins for commingled food and beverage containers, and separate set-outs for paper grades);
- providing adequate containers for storage and set-out of recyclables; and
- establishing drop-off sites to augment door-to-door collection (such as at disposal facilities if residents or businesses self-haul trash and at decentralized locations around the community).

6. Institute economic incentives that reward waste reduction and recovery over disposal, such as reduced tipping fees for delivering recyclable and compostable materials to drop-off sites, tax incentives to encourage businesses and haulers to recycle, and pay-as-you-throw fees for trash collection. Eliminate any subsidies for waste burning.

7. Enact or push for policies and regulations to improve the environment for recycling and recycling-based businesses. These might include:

- Banning waste incineration. Incinerators compete for the same materials and financial resources as waste reduction strategies and encourage wasting.
- Banning products that cannot be reused, repaired, recycled, or composted.
- Requiring residents and businesses participate in recycling and composting programs. Local ordinances can either require residents and businesses to source-separate or ban them from setting out designated recyclable or compostable materials with their trash. Retain authority over the collection and handling of municipal discards so that haulers undertake, encourage, and invest in recycling
- Banning recyclable and reusable materials and products from landfills and incinerators.
- Banning single-use disposable products from public events and festivals and as many other places as possible.
- Instituting or expanding existing beverage container deposit systems. Amend laws to require refillable containers.
- Establishing recycling market development zones with incentives to create industrial parks for reuse, recycling, and composting firms.
- Instituting building policies that require reuse and recovery of building materials in new construction and in building deconstruction projects. Establishing a municipal, regional, or national disposal surcharge (funds could be used to establish a Solid Waste Reduction, Recycling, Composting Authority that awards grants and loans to industry and nonprofit recycling operations).
- Supporting state and national mandates and goals, which can be very effective in increasing recycling levels. In the United States, state waste reduction goals, requirements, and policies encourage governments at the local level to implement waste reduction programs. State beverage container deposit laws and landfill bans on recyclables materials have, for instance, provided recycling-based businesses with needed materials.
- Supporting state and national policies that will help ensure the prices we pay for our goods and services reflect the true cost of providing them. Policies ending subsidies for virgin material extraction and taxing polluting industries are examples.
- Enacting a Toxics Use Reduction Act to encourage industries to reduce the use of toxic materials in their processes and products.

8. Develop markets for materials with an eye toward closing the loop locally (that is, within the local economy), producing high-value end products, and linking recycling-based economic development with a larger vision of sustainable community development. Minimum recycled-content policies, grant and loan programs, and recycling market development zones have encouraged the development of recycling-based manufacturing. Acquire public property for reuse, recycling, and composting in order to provide a stable land base for eco-industrial parks and reuse and recycling facilities. Support local nonprofit or for-profit mission-driven recyclers and reuse operations and the informal recycling sector. Community-based recyclers are in business for the good of the community and often provide services that the market undervalues. The informal sector likewise provides undervalued services and often does so free of charge to waste generators and local government. Implement or expand procurement of recycled-content products. If you're not buying recycled, you're not recycling.

9. Work to hold manufacturers responsible for their products throughout their life-cycle. Local government can press for extended producer responsibility (EPR) at the state and national levels. In particular press for state and national efforts to work with manufacturers to voluntarily reduce packaging and meet minimum recycled-content standards for products and packaging. If goals are not met, push for institution of a regulatory framework. Local government can pass producer responsibility resolutions calling on producers to share the responsibility for their products and on state and national legislatures to shift the burden of managing discarded products and packaging from local governments to the producers of those products. Local government can also pass local ordinances banning use and/or sale of certain types of products and packaging that cannot be reused, repaired, recycled, or composted.

10. Educate, educate, educate. Education and outreach is critical. Educational and technical assistance programs provide residents and businesses with information about "how" and "why" to reduce, reuse, recycle, and compost. Launch a public information campaign that will allow consumers to make smart choices when making purchases. Public education campaigns can also highlight the environmental and economic benefits of preventing, reusing, and recycling discards and connect the role these activities play in moving toward a sustainable economy.

Source: Brenda Platt, Institute for Local Self-Reliance, Washington, D.C., U.S., 2004.

Conclusion

The solid waste management crisis in the global South is clear. Landfills and dumpsites are overflowing, tempting many local governments to embrace incineration as a way to address disposal needs. These incinerators threaten to overwhelm municipal budgets, pollute the environment, and put the informal recycling sector and many people's livelihoods at risk. Clearly communities need to build adequate discard management systems. The key to healthy communities is to redirect the millions of dollars in investments slated for incineration systems into waste prevention and reduction and zero waste systems that maximize both return on investments and economic development opportunities.

Incinerators do not magically make municipal discards disappear. Rather they are the most costly of all discard management options, result in air and water pollution, waste raw materials, engage communities in contentious siting battles, and still need to be supplemented by landfills. With incineration, communities also lose the opportunity to move wastepickers from their dangerous, poverty-stricken lifestyles into safe, secure, long-term employment.

Moving toward 50% and higher waste diversion requires a paradigm change from our traditional waste management systems. Communities wishing to reduce disposal and save money and material resources must develop separate handling systems for discarded materials and put in place policies to support waste avoidance and recovery. Achieving maximum recovery of discarded materials and reducing the need for disposal is a huge task. It requires action and cooperation by individuals, businesses, and government at all levels. Sweeping change cannot be expected to occur overnight. Nor can it be accomplished without substantial investment and leadership. As long as waste planners focus on short-term, "black box" solutions, no real change can result. Furthermore, experience has shown that sustainable resource conservation systems cannot be decreed from above. Government and planners must involve businesses, community-based enterprises, the informal recycling sector, and individuals in the planning process, an involvement that is generally lacking wherever incinerators are proposed.

Many communities in the global South are faced with making a choice between pollution prevention and discard management versus selecting a waste disposal option that will have long-term negative impacts on the environment and drain money and resources from the local economy. The "pollution prevention" option requires thought, skill, planning, new technologies, capital investment, a commitment to a long-term future and to social values that reach beyond the next quarterly profit-and-loss statement. The "burn it up" or "bury it" options require only a contractor willing to reap profit and a government agency willing to toss money away while overlooking serious health hazards created by facilities. On the other hand, aiming for zero waste will protect the environment, create jobs, and strengthen local and regional economies. But if solid waste planners simply pay lip service to the ideas, make minimal investments, and abandon the effort at first difficulty, our communities will continue to suffer under mountains of trash. Let us not send our resources — human, material, and financial — up in flames.

The key to healthy communities is to redirect the millions of dollars in investments slated for incineration systems into waste prevention and reduction and zero waste systems that maximize both return on investments and economic development opportunities.

Endnotes

[1] In this report we use the terms "industrializing" nations or "less industrialized" nations rather than the more commonly used "developing" nations or "less developed" nations. This report also uses "the global South" as a synonym for industrializing countries.

[2] The United Nations reports the urban population of less industrialized regions has grown from 981 million in 1980, to 1.9 billion in 2000. The U.N. expects this population to double again by 2030.

[3] Michelle Allsopp, Pat Costner and Paul Johnston, "Incineration And Human Health: State of Knowledge of the Impacts of Waste Incinerators on Human Health," Greenpeace Research Laboratories, University of Exeter, UK, March 2001. Available at <http://archive.greenpeace.org/toxics/reports/euincin.pdf>

[4] Roberta Crowell Barbalace, The History of Municipal Waste, published on the KLBProductions.com website <http://environmentalchemistry.com/yogi/environmental/wastehistory.html>.

[5] The Association of Science-Technology Centers Incorporated and the Smithsonian Institution Traveling Exhibition Service, *Rotten Truth about Garbage, a Garbage Timeline*. Available on the website of the Association of Science-Technology Centers, <http://www.astc.org/>.

[6] Project Integra, "Energy Recovery Incineration," 1996, available on the Project Integra web site at <http://www.integra.org.uk/facts/extrafacts/energyinc.html>.

[7] Neil Seldman, "Recycling-History in the United States, "*Encyclopedia of Energy Technology and the Environment*, Attilio Bisio and Sharon Boots, editors. John Wiley & Sons, Inc.,1995. pp. 2354-5; and personal communication with Paul Connett, Waste Not, Canton, New York, U.S. (October 5, 2001).

[8] Phil Davis, "Report on Municipal Waste Incineration," Birmingham (UK) Friends of the Earth, 1994. Available at <http://web.bham.ac.uk/c.m.tarpey/phil.htm>.

[9] "Hundreds of Dirty Incinerators at End of Road," Asahi Shimbun, May 29, 2002.

[10] Tom Prendeville, Earthwatch, Friends of the Earth, Dublin, Ireland, personal communication, October 2001.

[11] T. Rand, J. Haukohl, U. Marxen*, Municipal Solid Waste Incineration: Requirements for a Successful Project*, World Bank Technical Paper Number 462, The World Bank, Washington, D.C., U.S., June 2000, p. 25.

[12] Ibid.

[13] Ibid., p. 26. Note these costs are for a facility producing steam for electricity and equipped with a "mid-level" air pollution control system. The authors of this report state, "When implementing an MSW incineration plant the technology must be feasible and proven. At present, only the mass burning incinerator with a movable grate fulfills these criteria."

[14] "The Construction Cost of Municipal Waste Incinerators, Counter Measures against Dioxin, The Entire Picture of Domestic Expenditure and its Trend," Greenpeace Japan/Greenpeace International, 2001.

[15] Based on cost data reported in In-Depth Studies of Recycling and Composting Programs: Designs, Costs, Results (Washington, D.C., U.S.: Institute for Local Self-Reliance, 1992).

[16] Compromisso Empresarial para Reciclagem (CEMPRE), "With little investment recycling can generate thousands of new jobs," *CEMPRE News*, May 2000, Number 50.

[17] Approximately 124,800 tons of material are sorted per year by 1,111 workers (700 of whom are girls and women who sort manually; another 411 work at intermediary trading enterprises which further processes and sorts materials). Note that employment figures do not include the 598 workers who make a living by collecting materials.

[18] The Mokattam zabbaleen collect about 1,500 tonnes per day of Cairo's waste. Of this, 80% is recovered, and then approximately 80% of the amount recovered flows through Mokattam's 228 micro-enterprises.

[19] Sorting conditions for workers are less than ideal and many of the recycling techniques in use would benefit greatly from technological upgrades. Technical support and credit to allow these entrepreneurs to develop and adopt appropriate technologies would increase the costs of recycling in Egypt but

still make it far more competitive than incineration. *The Informal Solid Waste Sector in Egypt: Prospects for Formalization* (Cairo: Community and Institutional Development, January 2001).

[20] Based on cost data reported in *In-Depth Studies of Recycling and Composting Programs: Designs, Costs, Results* (Washington, D.C., U.S.: Institute for Local Self-Reliance, 1992)

[21] Argonne National Laboratory, "Energy and Environmental Systems Analysis: Technology Summary I.1: Landfills: Reducing Landfilling of Waste," 1993.

[22] GAIA's Waste Incineration Database maintained by Pawel Gluszynski, Waste Prevention Association, Krakow, Poland. Please contact GAIA at info@no-burn.org for more information on this database.

[23] "Japan Blamed for Coercing Thai Incinerator Purchases," *Environment News Service*, 9 February 2000.

[24] Brenda Platt and Neil Seldman, "Wasting and Recycling in the United States 2000," GrassRoots Recycling Network, Athens, Georgia, U.S., 2000, p 27.

[25] Juwita Mudzafar, "Waste Management In Developing Countries," *G-15 Update*, Volume 4 No. 1, January 2001.

[26] United Nations Environment Programme International Environmental Technology Centre, "International Source Book on Environmentally Sound Technologies (ESTs) for Municipal Solid Waste Management: IECT Technical Publication Series 6," 1996, available at <http://www.unep.or.jp/ietc/ESTdir/Pub/MSW/index.asp>.

[27] Jim Puckett, "Something Rotten From Denmark: The Incinerator 'Solution' to Aid Gone Bad in Mozambique," *The Multinational Monitor*, December 1998, Volume 19, Number 12. Article available at <http://www.essential.org/monitor/mm1998/98dec/evironment.html>.

[28] GAIA's Waste Incineration Database maintained by Pawel Gluszynski, Waste Prevention Association, Krakow, Poland. Please contact GAIA at info@no-burn.org for more information on this database.

[29] Juan Rosario, Mision Industrial de Puerto Rico, San Juan, Puerto Rico, personal communication, October 30, 2001.

[30] *Final Technical Support Document for HWC MACT Standards Volume III: Selection of MACT Standards and Technologies* (Washington, DC: U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response, July 1999; and *Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds, Part I: Estimating Exposure to Dioxin Like Compounds, Volume 2: Sources of Dioxin Like Compounds in the United States*, Draft Final Report EPA/600/P-00/001Bb (Washington, DC, U.S.: U.S. EPA, September 2000), as posted at posted at <http://www.epa.gov/ncea>.

[31] UK Department for Environment, Food & Rural Affairs, "Waste Strategy 2000 for England and Wales, Part 1 & 2," May 25, 2000, updated 10 August 2000, available at <http://www.defra.gov.uk/environment/waste/strategy/index.htm>.

[32] Dr. Paul Connett, "Medical Waste Incineration: A Mismatch Between Problem and Solution," available on the Global Alliance for Incinerator Alternatives web site <http://www.no-burn.org/resources/library/mismatch.pdf>. Site visited August 26, 2001.

[33] Graham Woe, community activist, Sheffield, United Kingdom, personal communication, April 20, 2001.

[34] Lee Dae Soo, "Anti-Incineration Movements and Paths Towards Alternatives in Korea," Korea Waste Free Network, South Korea, 2001.

[35] United Nations Environment Programme International Environmental Technology Centre, "International Source Book on Environmentally Sound Technologies (ESTs) for Municipal Solid Waste Management: IETC Technical Publication Series 6," November 1996, available at <http://www.unep.or.jp/ietc/ESTdir/Pub/MSW/index.asp>.

[36] MacLeod, Scott, "Olivine plant in US shut for breaking law," Waikato Times (Hamilton, New Zealand), April 17, 1998.

[37] Waste Not Asia Conference, South Korea Report, Korea Waste Movement Network, 2001.

[38] Sandra, J. Cointreau and Maorten de Kadt. 1991. "Living With Garbage: Cities Learn to Recycle." Development Forum, January-February: 12-13.

[39] Hands On, "Waste Busters," Television trust for the Environment (TVE) EARTH REPORT series, July 31, 2000. Available at <http://info.tve.org/ho/printable.cfm?aid=640>.

[40] GAIA's Waste Incineration Database maintained by Pawel Gluszynski, Waste Prevention Association, Krakow, Poland. Please contact GAIA at info@no-burn.org for more information on this database.

[41] Juan Rosario, Mision Industrial de Puerto Rico, San Juan, Puerto Rico, personal communication, November 19, 2001.

[42] C. Bartone, 1988. "The Value in Wastes." *Decade Watch*, September, pp. 3-4. Cited in Martin Medina, "Informal Recycling and Collection of Solid Wastes in Developing Countries: Issues and Opportunities," The United Nations University Institute of Advanced Studies Working Paper no. 24, July 1997. Available at <http://gdrc.org/uem/waste/swm-ias.pdf>.

[43] Japan International Cooperation Agency, "The Study on Solid Waste Management for Metro Manila in the Republic of the Philippines: Final Report," March 1999.

[44] Juan Rosario, Mision Industrial de Puerto Rico, San Juan, Puerto Rico, personal communication, November 19, 2001.

[45] Ibid.

[46] Irene Hors, "Fighting corruption in the developing countries," *OECD Observer*, July 7, 2000.

[47] Martine Milliet-Einbinder, "Writing off tax deductibility: The tax deductibility of bribes is a practice which the Convention has made easier to abolish," *OECD Observer*, May 26, 2000.

[48] Juan Rosario, Mision Industrial de Puerto Rico, San Juan, Puerto Rico, personal communication, November 19, 2001.

[49] Ibid.

[50] K. Jay and Steiglitz, Identification and Quantification of Volatile Organic Component in Emissions of Waste Incineration Plants," Chemosphere Vol.30 No.7 (1995), pgs 1249-1260.

[51]Michelle Allsopp, Pat Costner and Paul Johnston, "Incineration and Human Health: State of Knowledge of the Impacts of Waste Incinerators on Human Health," Greenpeace Research Laboratories, University of Exeter, UK, March 2001, pp. 6-7. Available at: <http://archive.greenpeace.org/toxics/reports/euincin.pdf>

[52] Ibid., pp. 19-23.

[53] Ibid., pp. 25-35.

[54] Dr. Paul Connett, "Municipal Waste Incineration: A Poor Solution for the Twenty First Century," presentation at the 4th Annual International Management Conference, Nov. 24 & 25, 1998, Amsterdam. Article available at <http://www.no-burn.org/resources/library/Poor_solution.pdf>.

[55] Jeffrey Morris and Diana Canzoneri, *Recycling Versus Incineration: An Energy Conservation Analysis*, prepared for Pollution Probe (Toronto, Ontario, Canada) and Work on Waste USA (Canton, NY, U.S.) by Sound Resource Management, September 1992.

[56] Richard Klein, Community & Environmental Defense Services, *Citizen Perspective on Siting Solid Waste Facilities*, presented to the Maryland Solid Waste Task Force (Owings Mills, Maryland: October 12, 1999), available on the web at <http://www.ceds.org/Landfill.PDF>.

[57] Shiv Kumar, "Mumbaiites resort to self-help to tackle civic issues," India Abroad News Service, June 5, 2000.

[58] A barangay is the smallest unit of government in the Philippines. A barangay has a captain and a council. It can formulate its own ordinances needed for governance.

[59] Susanne Dittke, "Integrated Waste Management Strategies for Industry and Commerce," City of Cape Town (CMC Administration), Waste Management Department, and City of Cape Town Integrated Waste Exchange, "South African Success Stories," available at <http://www.capetown.gov.za/iwe/Success_stories.asp>, site visited August 20, 2001.

[60] Poornima Chikarmane and Lakshmi Narayan, "Formalising Livelihood: Case of Wastepickers in Pune," *Economic and Political Weekly*, October 7, 2000.

[61] Bharati Chatuverdi, Chintan Environmental Action and Research Organization, New Delhi, India, personal communication, April 2003.

[62]For a solid waste management plan based on investing in small businesses formed by garbage pickers see Neil Seldman, *Report on Solid Waste Management in Medellin, Columbia* (World Bank: Washington, D.C., U.S., 1982).

[63] Poornima Chikarmane and Lakshmi Narayan, "Formalising Livelihood: Case of Wastepickers in Pune," *Economic and Political Weekly*, October 7, 2000.

[64] Ravi Agarwal, Srishti, New Delhi, India, personal communication, October 21, 2001.

[65] Planning Commission on "Urban Solid Waste Management in India," GOI (1995).

[66] Ravi Agarwal, Srishti, New Delhi, India, personal communication, June 14, 2001.

[67] European Commission, *Success Stories on Composting and Separate Collection* (Luxembourg: Office for Official Publications of the European Commission, 2000), p. 8, available at <http://europa.eu.int/comm/environment/waste/compost/index.htm>.

[68] Institute for Local Self-Reliance, *Cutting the Waste Stream in Half: Community Record-Setters Show How* EPA 530-R-99-013 (U.S. Environmental Protection Agency, Washington, D.C., U.S.: June 1999).

[69] Ibid.

[70] Institute for Local Self-Reliance, *Innovation, Leadership,Stewardship* (The Alameda County Source Reduction and Recycling Board, San Leandro, California, U.S.: 2002).

[71] I. Maumdar, "India," *Warmer Bulletin*, Number 34, August 1999, p. 3.

[72] Kisan Mehta, President, Save Bombay Committee, Bombay, India, personal communication, September 2, 2001.

[73] Bharati Chatuverdi, Chintan Environmental Research and Action Group, New Delhi, India, personal communication, April 2003.

[74] Christian Gonzalez del Carpio, "Redirecting Organics in Mexico City," *BioCycle*, Volume 38, Number 6, June 1997, p. 30.

[75] Jitti Mongkolnchaiarunya, *Implementing Waste Management Projects in an Effective Way in Cambodia, Lao PDR, Vietnam and Thailand*, Canadian Universities Consortium Urban Environmental Management Project at the Asian Institute of Technology, Bangkok, Thailand, August 31, 1999.

[76] Fr. Norberto Carcellar, *Payatas Environmental Development Programme: Micro-Enterprise Promotion and Involvement in Solid Waste Management*, UNDP / UNCHS (Habitat) / World Bank Urban Management Programme Regional Office for Asia and the Pacific, Kuala Lumpur, Malaysia, Asia Occasional Paper Series No. 36, May 1997.

[77] "Recycling Attracts New Business," *CEMPRE News* by Compromisso Empresarial Para Reciclagem (CEMPRE), Sao Paulo, Brazil, No. 56, May 2001.

[78] *The Informal Solid Waste Sector in Egypt: Prospects for Formalization* (Cairo: Community and Institutional Development, January 2001), p. 35.

[79] Ibid., pp. 22, 23, 36.

[80] Elizabeth Ninan, "Bid to motivate youth to keep city clean," *Bombay Times*, November 20, 1999.

[81] Laila Iskander Kamel, Managing Director, Community and Institutional Development, Cairo, Egypt, personal communication, October 25, 2001. Ms. Iskander Kamel points out that citizens are "waiting for the Ministry of the Environment to announce it as a citywide system and to see their waste being collected separated. However, there is no condition being placed on the contractors (three multinationals have won three of the four zones for the waste management of Cairo's waste) to implement any source separation scheme. They are just being asked to recover and recycle 20% of the waste!"

[82] U.S. Environmental Protection Agency, "Product Stewardship: Packaging: International Initiatives," available at <http://www.epa.gov/epr/products/pintern.html>. Site visited August 24, 2001. And Raymond Communications, Inc., "Latin America Getting Serious on Recycling," *Recycling Laws International*, May 2001.

[83] Xu Xiaomin, "Sale boosts 'green,'" *Shanghai Star*, August 25, 2000.

[84] Plastic bags are easily carried by the wind. They hang in bushes, float on rivers, flap from fences, clog drains, choke animals, and blight landscapes. David Chazan, "A World Drowning in Litter," BBC News Online, March 4, 2002.

[85] Pradip Chatterjee, DISHA, India, personal communication, October 5, 2001; and The Polybag Campaign Page, *Environment Newsletter*, DISHA.

[86] Nityanand Jayarman, India, personal communication, August 16, 2001.

[87] Akila Dinakar, "TNPCD Campaign Against Plastics," *The Hindu* (Chennai, India: September 11, 2001).

[88] CEMPRE,"Brazil takes first step in altering tax system for recycled products." CEMPRE News, Number 54, January 2001. Available on web site at <http://www.cempre.org.br/ingles/informa/jan01.htm>. Site visited on August 27, 2001.

[89] CEMPRE, "Brazilian Environment Ministry increases funds for integrated urban waste management projects threefold," *CEMPRE News*, May 2001, Number 56.

[90] CEMPRE, "Waste market ensures privacy for users and aims to encourage companies to manage their waste and create specialized jobs," *CEMPRE News*, November 2000, Number 53.

[91] Ravi Agarwal, Srishti, New Delhi, India, personal communication, October 21, 2001.

[92] Munster Express Online, "Councilors very much in favour of Great Island waste proposal," February 12, 1999.

[93] Shiv Kumar, "Mumbaiites resort to self-help to tackle civic issues," India Abroad News Service, June 5, 2000.

[94] Brenda Platt and David Morris, *The Economic Benefits of Recycling* (Washington, D.C., U.S.: Institute for Local Self-Reliance, February 1993), p. 9.

[95] Michael Lewis, *Recycling Economic Development through Scrap-Based Manufacturing* (Washington, D.C., U.S.: Institute for Local Self-Reliance, 1994).

[96] Furedy, C. 1992. "Garbage: exploring non-conventional options in Asian cities." *Environment & Urbanisation* 4(2) (Oct.): 43-60.

[97] Poornima Chikarmane and Lakshmi Narayan, "Formalising Livelihood: Case of Wastepickers in Pune," *Economic and Political Weekly*, October 7, 2000.

[98] Neil Seldman, "Life and Death in the Landfill – There is a Better Way," article from the Institute for Local Self-Reliance, November 2000, available at <http://www.ilsr.org/recycling/other/landfillart.html>.

[99] Poornima Chikarmane and Lakshmi Narayan, "Formalising Livelihood: Case of Wastepickers in Pune," *Economic and Political Weekly*, October 7, 2000.

[100] Bharati Chatuverdi, " Public Waste, Private Enterprise: A Equity into the Issue of Integrating Ragpickers into Formal Solid Waste Management Systems," published in association with Heinrich Boelle Foundation, 1998.

[101] Neil Seldman, "Life and Death in the Landfill – There is a Better Way," article from the Institute for Local Self-Reliance, November 2000, available at <http://www.ilsr.org/recycling/other/landfillart.html>. For a solid waste management plan based on investing in small businesses formed by garbage pickers see Neil Seldman, *Report on Solid Waste Management in Medellin, Columbia* (World Bank: Washington, D.C., U.S., 1982).

[102] Ibid.

[103] Neil Seldman, "Life and Death in the Landfill – There is a Better Way," article from the Institute for Local Self-Reliance, November 2000, available at <http://www.ilsr.org/recycling/other/landfillart.html>.

[104] "Brazilian Environment Ministry increases funds for integrated urban waste management projects threefold," *CEMPRE News*, São Paulo, Brazil, No. 56, May 2001.

[105] Poornima Chikarmane and Lakshmi Narayan, "Formalising Livelihood: Case of Wastepickers in Pune," *Economic and Political Weekly*, October 7, 2000.

[106] Ibid.

[107] *The Informal Solid Waste Sector in Egypt: Prospects for Formalization* (Cairo: Community and Institutional Development, January 2001).

[108] Ibid., p. 64

[109] Ibid., p. 65.

Contact information

GAIA Secretariat
Unit 320 Eagle Court Condominium,
26 Matalino St., Barangay Central
Quezon City 1101, The Philippines
Phone: 63 2 9290376
Fax: 63 2 436 4733
Email: info@no-burn.org
www.no-burn.org

GAIA
1442A Walnut Street #20
Berkeley, CA 94709 USA
Phone: 1 510 883 9490
Fax: 1 510 883 9493
Email: gaia@no-burn.org

Bharati Chaturvedi
Chintan Environmental Research
and Action Group
238 Sidhartha Enclave New Delhi.
110014 India
Phone: 91 11 3381627
E-mail: bharatich@hotmail.com

CID - Community and Institutional
Development
17 Mar'ashly Street, Zamalek,
7th floor, Cairo, Egypt
Phone: 202 7380832
Fax: 202 7352660
E-mail: cidegypt@cid.com.eg
www.cid.com.eg

Institute for Local Self-Reliance
927 15th Street, NW, 4th Floor
Washington, DC 20005, USA
Phone: 1 202 898 1610
Fax: 1 202 898 1612
Email: wastetowealth@ilsr.org
http://www.ilsr.org

Jayakumar C.
Thanal Conservation Action
& Information Network
L-14 Jawahar Nagar ,
Kawdiar, Thiruvananthapuram
Kerala , India 695003
Phone: 91 471 727150
Fax: 91 471 311896
Email: thanal@md4.vsnl.net.in
www.zerowastekovalam.org

Lucy White
Zero Waste New Zealand Trust
PO Box 33 1695, Takapuna
Auckland, New Zealand
Phone: 0064 9 4860736
Email: lucywhite@zerowaste.co.nz
www.zerowaste.co.nz

Mother Earth Unlimited
59 Salvador St., Loyola Heights
Quezon City 1112 Metro Manila,
The Philippines
Phone: 632 925 3829
Fax: 632 925 3829
E-mail: motherearth@surfshop.net.ph

Pawel Gluszynski
Waste Prevention Association "3R"
P.O. Box 54
30-961 Krakow 5
Poland
Phone: 48 12 6549986
Fax: 48 12 4210909
E-mail: pawel@otzo.most.org.pl
www.otzo.most.org.pl

Priya Salvi
PRAKRUTI
620 Jame Jamshed Road,
Dadar East, Mumbai 400 014,
India
Phone: 91 22 414 9688
Fax: 91 22 415 5536
E-mail: priya_salvi@yahoo.com

Srishti/Toxics Link
H2 Jungpura Estension
New Delhi 110014
India
Phone: 91 11 432 0711 or 432 8006
Fax: 91 11 432 1747
E-mail: shristidel@vsnl.net
www.toxicslink.org

T.K. Ramkumar
Exnora International
12 Pelathrope, Mylapore,
Chennai 600004, India
Phone: 91 44 34959404
E-mail: exnora@vsnl.com
www.exnora.org