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Economic Instruments for Solid Waste Management: Global Review and Applications for Latin America and the Caribbean

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Integration and Regional Programs Department
Sustainable Development Department

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Cover: Shell-shaped pendant belonging to the Quimbaya prehispanic Society.
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Inter-American Development Bank
Regional Policy Dialogue

The **Regional Policy Dialogue** was established in December 1999 by the initiative of the Board of Executive Directors. The objective was to create a forum of communication within the Bank to expand and enhance dialogue among the countries in the region by sharing experiences, preparing them to face the great challenges of globalization, and generating processes for regional cooperation. The Bank identified seven areas to be included on the Dialogue and created seven specialized networks in which government officials at the Vice-Minister level from Latin America and the Caribbean, who are responsible for decision making and public policy design, participate.

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Foreword

The main subject selected by the Environment Network of the Regional Policy Dialogue during its February 12–13, 2003 meeting in Washington, D. C was the application of economic instruments and incentive-based mechanisms in the environmental management sector. To date, the countries in the region have relied primarily on the application of command-and-control instruments as part of their environmental management agenda. There is growing interest in the region —and much to be learned— regarding how economic instruments can be applied effectively and efficiently in order to properly complement the traditional command and control approach.

This report seeks to encompass the main elements of these discussions in the area of solid waste management. The improvement of the solid waste management is one of the main environmental priorities for most Latin American and Caribbean countries, since it would directly improve the living conditions for millions of people, particularly in terms of health effects. The report includes documents prepared by professionals with significant experience with solid waste management. Their work shows that the selection, design and implementation of an appropriate economic instrument is a complex process that requires extensive knowledge and information on the function and application of such instruments. The report also shows that there are a wide variety of economic instruments available to chose from when designing solid waste policies and action plans, but that, in order to generate exemplary results, the particular instrument that is utilized must be chosen carefully according to the specific conditions of the situation in which it is to be applied.

The Inter-American Development Bank considers it important and necessary to disseminate the discussion of the II Meeting of the Environment Network of the Regional Policy Dialogue to enhance the regional understanding of this very relevant topic. This report is likely to be of particular interest to those seeking to draw lessons learned from the global and regional experiences provided. Some of the cases described in the report may also prove useful as a guide in the development and design of economic instruments. As this report demonstrates, economic instruments, when properly applied, can have a positive impact on solid waste management in the region.

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General Introduction

Economic instruments have drawn increasing attention in recent years as important tools for reinforcing and implementing environmental legislation while simultaneously contributing to sustainable development. Specifically, economic instruments for solid waste management promise to both lessen the size of the solid waste management problem and improve the delivery of solid waste collection and disposal services. The 1992 Rio Declaration on Environment and Development endorsed the use of economic instruments as a means to obtain a sustainable environmental improvement. This endorsement addresses a development strategy wherein there is a continuous effort to balance economic and environmental needs. In each country the conditions affecting the choices will be different. Each country will need to choose those economic instruments that have a potential for improving its own particular situation.

The objective of the report is to present the main documents that were discussed in the II Environmental Dialogue in the context of the topic "Economic Instruments for Solid Waste Management: Global experience and their applicability in Latin America and the Caribbean". This is part of the Network's objective to disseminate, transmit and share relevant technical material produced by the Dialogue.

The report has been organized into two chapters based on separate works of individual authors that were presented at the II Dialogue meeting. The first chapter of the report contains an overview of global experiences with the application of economic instruments in solid waste management. It is divided into four sections beginning with a description of the solid waste sector and of management practices and opportunities for the use of economic instruments in the sector. Section two presents an empirically exemplified typology of these instruments. Section three outlines criteria for choosing among economic instruments in the solid waste sector and, finally, section four presents general recommendations.

The second chapter contains the syntheses of four case studies of the use of economic instruments for solid waste management in three countries in the region. The first studies the collection and disposal of solid waste in Santiago municipality and recycling in La Reina municipality in Chile. The second analyze Rio de Janeiro's improvement of its urban trash and garbage services. The third studies experiences with Sustainable Recycling of PET Bottles in Rio de Janeiro. Finaly, the experiences and lessons learned from the use of economic instruments to finance a solid waste management project in Montebello municipality in Colombia are described in the fourth study.

Examples from a wide range of high-income and developing countries are included in the review table at the end of the report with numerous references, most of which are accessible through the internet citation provided in the bibliography.

Economic Instruments for Solid Waste Management: Global Review[1]

SOLID WASTE MANAGEMENT

Solid waste quantities and related environmental problems are growing quickly globally. Solid waste generation is a function of private consumption expenditure, and thus it is correlated to gross domestic production, population growth, and increase in income. In high-income countries, private consumption expenditure generally falls between 50% -70% of gross domestic product, and in absolute terms, it has grown 20%-50% over the last decade in most of these countries (OECD 2001). High-income countries produce about three times more general municipal waste per person than developing countries, and significantly higher quantities of hazardous wastes (Cointreau et al. 2000). As more countries achieve higher economic standards of living, the solid waste burden on the Planet's environment will increase, possibly affecting water and air quality, both locally and globally. However, higher standards of living tend to correlate with increased capacity to manage the solid waste that is produced. The following Table 1 provides a perspective on municipal waste generation as it relates to income levels and urbanization.

[1] This chapter is a modified and amplified version of a document entitled Economic Instruments for Solid Waste Management –A Global Framework Paper, by Sandra Cointreau, with input from Constance Hornig on matters of solid waste regulatory controls, financial instruments, and service contracting. Nancy Cunningham developed case example material on Philadelphia, PA., and Maya Cointreau conducted literature search and provided final editing to the original version of the document, which was presented at the II dialogue meeting of the Environment Network. Contributions and final editing of this text were provided by Niels Holm-Nielsen and Michael Toman.

COSTS OF SOLID WASTE SERVICES

Unit labor prices (e.g., salary/month) are relatively low in developing countries, so there is an erroneous tendency to think that solid waste service costs are also low. While unit labor prices of solid waste services are low in poor countries, unit capital costs for trucks, unit prices for spare parts, and fuel prices are all relatively expensive. The relatively high prices of these items in developing countries reflect the fact that the items have a high foreign exchange component. In addition, customs duties commonly further increase these prices by as much as 100%. Overall labor costs tend to be high because of unproductive labor practices, redundant labor, and irrational service routes. In addition, the task of collecting waste in poor countries is often greater than it is in high-income countries. Residents tend not to fully cooperate with the service and do not always put their waste at the curbside in a covered container. Instead, they use cartons and baskets and sometimes just make a small pile, which means a considerably greater effort for collectors. Furthermore, because of the dense development as well as the hot climate, daily collection is commonly necessary, as opposed to the weekly collection more typically found in high-income countries. The result is that a family in a poor country may have to spend a significantly greater portion of its income to fully cover solid waste services than might be spent by a family in a high-income country.

Solid waste management therefore amounts to a significant expense in developing countries. Many cities in developing countries spend from 20% to 40% of their municipal budgets on a combination of street sweeping, solid waste collection and disposal. Table 2 provides a perspective on how the costs are allocated in countries of various income levels.

TABLE 1

GLOBAL PERSPECTIVE ON SOLID WASTE QUANTITIES

	Low Income Country	Middle Income Country	High Income Country
Mixed urban waste – large city (kg/capita/day)	0.50 to 0.75	0.55 to 1.1	0.75 to 2.2
Mixed urban waste – medium-sized city (kg/capita/day)	0.35 to 0.65	0.45 to 0.75	0.65 to 1.5
Residential waste only (kg/capita/day)	0.25 to 0.45	0.35 to 0.65	0.55 to 1.0

Notes:

1. Country categorization by income is based on 1992 GNP data from the 1994 World Development Report published by the World Bank. Waste data based on a wet, "as received" condition (i.e., not oven dried).
2. For purposes of this table, a medium-sized city has 100,000 to 500,000 residents, and a large city has above 500,000 residents.
3. Urban waste includes residential, commercial, industrial and institutional waste, as well as street sweepings and yard waste. Construction/demolition debris is not included.
4. Recycling rates can effect a reduction of as much as 50% in the amount of waste requiring disposal. In the U.S. in 1995, recycling recovered 27% of all wastes generated, with paper recycling reaching 41% and yard waste composting reaching 38%.

Source: Sandra Cointreau.

Among the environmentally acceptable solutions, sanitary landfill is often the disposal method of choice because it usually presents the lowest cost. Sanitary landfill costs roughly 3-8 times more than open dumping with some grading to maintain truck access to the working face. Incineration is a capital- and energy-intensive option that is 5–10 times more costly than sanitary landfill for developing countries, and composting is 2–3 times more costly. The ranges are due to considerable geographical differences in the cost structures. Incineration and composting, like sanitary landfill, should be designed to comparable environmentally acceptable standards. Because they are substantially more costly than sanitary landfill, they are typically only considered when appropriate landfill is unavailable within a reasonable direct haul distance. Additional transfer system costs for reaching more remote sites may offset some of the savings of choosing sanitary landfill. Also, sales of recovered energy or compost could cover some of the cost differential. Collection costs generally amount to 70–80% of the total costs for competent solid waste management. Thus, the most economical choice between different forms of solid waste management can vary greatly over geographic regions. In northern European countries like Denmark, where most fuel is imported, land costs are very high, groundwater aquifers are high and costly to protect during land disposal, and dry combustibles in waste require to be source segregated, the costs for waste-to-energy may be competitive with those of sanitary landfill (Klarer et al. 1999). In countries like the U.S. or Canada where some fuel is locally produced, land costs are reasonable, and wastes are not segregated to get a dry combustible fraction, burning is considerably more costly than sanitary landfill. In general, land disposal remains the predominant means of disposal throughout the world, with sanitary landfill standards mostly limited to application in high-income countries and open dumping being the norm in lower-income countries.

SOLID WASTE MANAGEMENT AND THE ENVIRONMENT

Because solid waste is largely composed of organic matter, any method of waste disposal contributes to greenhouse gases. Open dumps contribute carbon dioxide gas as air pollution, and can have significant particulate emissions when openly burn-

TABLE 2

GLOBAL PERSPECTIVE ON COST OF PROPER SOLID WASTE MANAGEMENT COST VERSUS INCOME

	Low Income Country	Middle Income Country	High Income Country
Average waste generation	0.2 t/capita/y	0.3 t/capita/y	0.6 t/capita/y
Average income from GNP	370 $/capita/y	2,400 $/capita/y	22,000 $/capita/y
Collection Cost	10–30 $/t.	30–70 $/t.	70–120 $/t.
Transfer Cost	3–8 $/t.	5–15 $/t.	15–20 $/t.
Sanitary Landfill Cost	3–10 $/t.	8–15 $/t.	15–50 $/t.
Total cost without transfer	13–40 $/t.	38–85 $/t.	90–170 $/t.
TOTAL cost with transfer	16–48 $/t.	43–100 $/t.	105–190 $/t.
Total Cost per Capita	3–10 $/capita/y	12–30 $/capita/y	60–114 $/capita/y
Cost as % of income	0.7–2.6%	0.5–1.3%	0.2–0.5%

Table Notes:

1. Income based on 1992 Gross National Product data from the World Development Report 1994 published by the World Bank.
2. Costs are for owning, operation, maintenance, and debt service in 1995, assuming no equipment provision through grants. Appropriate (affordable) best practical standards of service and environmental protection for the skill and income level of the country are assumed.
3. If sanitary landfill can be located within an economic hauling distance that allows direct haul in collection vehicles, the cost of transfer can be avoided. An economic hauling time for a small truck carrying 2 to 6 tons commonly is within 30 minutes one-way from the collection area to the unloading point. Depending on traffic conditions, 30 minutes one-way would be 15 to 30 kilometers one-way. Larger trucks can readily extend the haul to 30 to 50 kilometers one-way.
4. $/t means US Dollars per metric ton, and $/capita/y means US Dollars per capita per year.

Source: Sandra Cointreau.

ing. The anaerobic biodegradation mechanisms prevalent in sanitary landfill generate methane, a particularly potent greenhouse gas compared to carbon dioxide. While composting is environmentally friendlier, it does produce carbon dioxide. Incineration produces carbon dioxide as well as a wide range of volatilized metals and complex organic gases, requiring extensive and sophisticated air pollution control systems, which renders the process economic infeasible for developing countries. In fact, few high-income countries are implementing new incineration systems due to costs as well as to public opposition to the gases that disperse over a very wide area due to the high stacks required. In addition, since solid waste collection requires motorized vehicles, rather than a fixed network of pipes and pumps, its energy requirements for fueling collection vehicles and the resulting air emissions from vehicles are significant and therefore contribute to air pollution.

All methods of waste disposal result in some contaminated drainage and surface runoff that require treatment. However, the land disposal systems could potentially present the greatest risk to groundwater and surface water, and thus require special systems to contain and treat leachate and all drainage. While waste disposal is not the major cost element within an overall solid waste system, environmental impacts associated with disposal can be most serious.

For that reason, waste recycling and resource recovery need to be given priority for their ability to divert waste from disposal. Also, changing the economics of disposal, e.g., by imposing high disposal tipping fees, can reduce the demand for disposal. Waste minimization efforts are critically

important to reduce the total quantity of waste requiring collection. Economic instruments that encourage people to generate less waste or somehow manage or reuse their own waste at the source are necessary.

COMMAND AND CONTROL APPROACHES

The standards and norms for each step in the process from waste generation to ultimate disposal are typically defined by laws and regulations that:

- Oblige waste generators to safely contain their wastes and discharge them at a scheduled time and in a prescribed manner for collection;
- oblige waste collectors to use suitable equipment and methods for collecting the waste in a safe and efficient manner; and
- oblige local governments to provide environmentally acceptable sites and methods for waste disposal.

The specific requirements in different countries are determined by the technical means available, local skills to implement the techniques, and local ability and willingness to pay for a prescribed level of environmentally safe waste management. Such standards and criteria are determined based on what is cost-effective (i.e., affordable and appropriate) in each country for the majority of those who generate waste. For each country, developing the command and control regulatory framework involves studying various solid waste management technologies, assessing their pros and cons, determining their costs, and making a decision on what technologies and standards of performance are locally practical and affordable. Some of the typical elements included in command and control approaches are:

- Waste storage container design standards;
- waste source segregation requirements;
- waste collection frequency and method requirements;
- facility citing criteria and public participation procedures;
- air, water, and noise emissions criteria;
- facility building codes and design standards;
- equipment design standards;
- pollution control design standards;
- operating standards;
- resource recovery by-product quality standards; and
- performance monitoring requirements.

In command-and-control regulation, motivation for compliance is designed to come from the desire to avoid penalty, whether financial or by exposure for non-compliance. In this framework, fines and penalties serve as disincentives for waste generators and various waste handlers to break the existing legal and regulatory framework. However, even the most appropriate and reasonable of regulatory standards may not be met if vigilance and enforcement of compliance are inadequate.

Each country has its own constraints on regulatory control, and thus its own special needs where economic instruments might bridge a gap. Due to a lack of competence, capacity and sometimes lack of political willingness, most developing countries, including many in Latin America, face problems with the overall enforcement and penalizing of non-compliance with the environmental regulatory standards. These problems generally include:

- Inadequate detail in the law regarding what is acceptable versus unacceptable behavior;
- lack of inspection staff and lack of transport for them to make their rounds;
- inadequate empowerment of inspectors to follow through on ticketing when offenses are identified;
- political intervention after ticketing occurs;
- disinterest within the court system for these minor offenses;
- inadequate police coverage to enable arrests and follow-though of arrests in the court system;
- lack of a court for minor offenses (such as a municipal court or a sanitation magistrate); and
- fines and penalties that are too small to be significantly deterring.

In a climate where performance monitoring and enforcement are inadequate, economic instruments may encourage voluntary compliance within the regulatory framework and therefore be a useful tool for solid waste management. In addition, economic instruments may have the effect of encouraging more environmentally-sound behavior at an aggregated level through the mechanisms of incentives and disincentives. Also, some economic instruments may improve performance in areas not covered by the command and control systems, and some are

meant to encourage performance beyond what is required.

INTEGRATING ECONOMIC INSTRUMENTS IN SOLID WASTE MANAGEMENT

In the environmental economics and policy literature, the term *economic instrument*[2] is generally understood to refer to a policy, tool or action which has the purpose of affecting the behavior of economic agents by changing their financial incentives in order to improve the cost-effectiveness of environmental protection efforts (pollution control and avoidance).

Economic instruments comprise all incentives/disincentives that mobilize the self-interest of consumers, producers, and service providers to make environmental improvements or reduce adverse environmental consequences. These instruments may be used to address basic environmental needs, or may motivate actions to address environmental protection beyond the prescribed minimum accepted standards of command-and-control regulatory approaches. The underlying logic for the use of economic instruments to decrease the human-produced stresses on the environment is that there is always a higher level of environmental performance that some polluters could achieve, but that the law cannot readily require. To make polluters go beyond regulatory requirements involves incentives. Economic instruments may provide these incentives and encourage people to extend their actions beyond the minimum standards required by law, resulting in "over-performance" as opposed to "compliance." Therefore, economic instruments have a theoretical potential to internalize negative environmental impacts in a cost-effective manner at a local, national and global scale.

Specifically, economic instruments for solid waste management can be used as a tool to:

- Reduce waste generation;
- decrease the amount of generated waste that is hazardous;
- segregate hazardous waste for special handling and disposal;
- optimize recovery, reuse and recycling of wastes;
- support cost-effective solid waste collection, transport, treatment and disposal systems;
- minimize adverse environmental impacts related to solid waste collection, transport, treatment and disposal systems; and
- generate revenues to cover costs.

Furthermore, the use of economic instruments as a pollution management tool appears to be morally attractive. There is a strong relationship between economic instruments and the polluter-pays principle. That principle involves allocating costs of waste management services, resource consumption, and pollution control to consumers and producers. It is inherent to this principle that the polluter bears all internal and external environmental costs, with the goal that all subsidies for resource use, production and waste management services be eliminated.

While many economic instruments are based on the polluter-pays principle, it is notable that most command-and-control regulations also cause the polluter to pay through investments and operating expenses to meet standards.

The main difference between the way command-and-control regulations and economic instruments work relates to the determining factors for their incentive structures and the flexibility of the instrument. "Command-and-control" actions operate more directly through norms, regulations, and sanctions to prescribe both the standards to be followed by economic agents and their decisions on what, how, when, where and how much to produce, consume, emit, and clean up. Therefore, these actions mandate a minimum standard to be achieved regardless of individual differences in the ability to comply with the regulation. Command-and-control actions rely on the enforcement of penalties and fines as disincentives against noncompliance, and thus motivate behavioral change. In contrast, the key features of economic instruments highlighted in the environmental economics and policy literature are (a) the more flexible and non-prescriptive nature of the actions required, which may allow reduced costs in meeting environmental norms; and (b) their dynamic incentives to cost-effectively reduce the creation of environmental harm through technical innovation in pollution control and avoidance. In other words, economic instruments rely more on economic incentives and on influence on behavior to motivate change, which means that individual differences in the marginal cost/marginal benefit equation will determine the chosen level of pollu-

[2] Economic instruments are also referred to as market-based instruments.

tion. An economic instrument requires that there be a foundation of command-and-control regulations. For example, under the concept of tradable emissions, dischargers have a specified emission limit, and trade is allowed if their emissions are below that limit. Thus, a firm can sell or trade the difference between its actual discharge and its allowable discharge. Economic instruments are commonly used as a complement to regulatory controls requiring change. These complementary economic instruments work to encourage compliance with the regulations, particularly in countries where enforcement and penalties associated with regulations do not provide adequate incentives. In using an economic instrument, the regulatory standard needs to be clear and the program of monitoring compliance needs to be adequate, implying that the success of the economic instrument is dependent on successfully implementing regulatory controls.

Some desired change is easier to implement through economic instruments, and other desired change is easier to implement through command-and-control regulations. It is not an either-or situation. For each country, the harmonious balance of regulatory controls and economic instruments will depend on local conditions and preferences. In high-income countries with well-staffed and well-equipped regulatory agencies as well as strong judicial response systems, strict regulatory standards may be readily implemented on an equitable basis, and economic instruments may be designed to encourage over-performance. However, in many developing countries, inspection and enforcement resources are limited, and political influences may lead to inequitable compliance requirements. In such cases, economic instruments may be designed for the achievement of more modest standards of performance rather than over-performance.

Some potential control approaches may have effects similar to those of economic instruments if their main purpose is to create a motivation for producers and consumers to change. For example, when governments ban specific constituents and products (such as mercury in batteries and thin-filmed plastic shopping bags), these bans directly affect production and consumption patterns. In those cases where the distinction between control and economic instruments may not be completely clear, this paper covers the topic as an instrument, electing to be inclusive rather than risking exclusion of a potentially important economic instrument.

TYPES OF ECONOMIC INSTRUMENTS

Traditionally, economic instruments have been viewed as those incentives or disincentives that influence waste generators—both consumers and producers—to minimize, recycle or recover waste. However, this paper has a broader scope that likewise includes those economic instruments that influence service providers.

The instruments described in this section, while very important for the solid waste sector, may not be generally applicable to other sectors in the overall field of environmental policy. Though economic instruments can increase management efficiency in most environmental sectors, differences in the characteristics of the sectors mean that approaches and experiences cannot always be readily transferred from one sector to another. For instance, while most solid waste is managed through labor-intensive and vehicle-intensive techniques (mobile sources), wastewater is managed by fixed pipe and pump networks (fixed sources). This creates differences in the capacity needed to monitor the services and therefore results in different demands for control approaches and enforcement.

Another related issue is that economic instruments that are developed for other sectors, such as instruments that reduce air pollution, can have an impact on solid waste management. The 1998 European Union Ozone Depleting Substances Regulation was designed to reduce the impact on the ozone layer by the release of ozone-depleting substances, such as those found in refrigerant fluids and foams. The United Kingdom already had a voluntary producer take-back system to deal with refrigerant fluids, but not with foams. Given the new requirement to also deal with the foams, a number of producers withdrew support for the take-back system. Local authorities in the United Kingdom were not prepared to fully address disposal and recovery requirements by the regulation deadlines. The result led to a significant storage problem, where refrigerators and freezers had to be stored until new processing facilities could be built or they could otherwise be exported to facilities in other European countries. The estimated cost for compliance in the 2002-3 fiscal year was $140 million. The cost is manifested in the solid waste sector, even though the economic instrument was designed to improve air quality (Frith 2002).

In order to ease the use of economic instruments as a tool for solid waste management, it would be

useful to have a stringent typology of the different instruments available. A thorough review of the global literature did not turn up any individual reference that dealt with the overall subject of economic instruments for the solid waste sector. Most references dealt either with the broad subject of economic instruments for environmental policy-making, or specifically discussed a single instrument in its application to the solid waste sector.

Additionally, the overview literature does not consistently categorize the various economic instruments applicable to environmental policy-making. The categories most commonly listed are shown in Table 3. While the literature shows general agreement on key subcategories of economic instruments (e.g., charges, tradable permits, deposit-refunds), it is noteworthy that the references do not necessarily use the same categories to group these subcategories.

Based on these categorizations and on the wide range of case studies of solid waste management reviewed for the development of this document, a useful taxonomy of economic instruments for solid waste management could encompass three main categories:

- **Revenue Raising Instruments** that include the various kinds of *user charges* for the provision of collection, transportation and final disposal services—including taxes levied for these purposes by different levels of government—that are the most basic economic instrument for this activity. Various kinds of *taxes directed at "internalizing" the externalities* associated with the production and disposal of wastes are a second form of instrument in this category. Unit taxes on final products and inputs (virgin or hazardous materials) may compensate for a difficulty in setting direct user charges and may provide funds for the financing of waste collection and disposal services. Other examples in this category include taxes reflecting residual pollution of air, water and soil at disposal sites. Finally, s*ubsidy reductions* that lower incentives to create or improperly dispose of wastes have a similar impact (and in practice also increase revenue flows).
- **Revenue Providing Instruments** that include s*ubsidies* of different kinds are the generic policy in this category. They seek to directly reward de-

TABLE 3

COMPARISON OF REFERENCES CATEGORIZING ECONOMIC INSTRUMENTS

World Bank (Huber et al. 1997)	Nordic Working Group on Environmental Economics (Duer 1995)	Environment Canada (Rolfe et al. 1993)	United Nations Environment Program (Rietbergen-McCracken et al. 2000)
• Fees, charges, taxes • Market creation (includes property rights, deposit systems, tradable permits) • Performance rating • Liability legislation (includes performance bonds) • Final demand intervention (includes eco-labeling, education, disclosure laws, blacklists/ polluter ratings)	• Charges, taxes, compensation • Tradable permits, bubbling, quotas • Investment support, subsidies • Deposit-refund systems • Liability schemes	• Charges, fees • Tradable permits • Deposit-refund systems	• Redefinition of property rights • Market creation (includes tradable permits) • Charge and fee systems • Fiscal instruments (includes taxes) • Deposit systems (includes performance bonds) • Financial instruments (includes subsidies grants, soft loans, funds) • Liability (includes insurance)

TABLE 4

TYPOLOGY OF ECONOMIC INSTRUMENTS

Revenue generating instruments	Revenue providing instruments	Non-revenue instruments
• Charges • Taxes • Subsidy reductions	• Subsidies • Grants • Tax credits • Development rights and property rights • Host community incentives • Funds	• Product and production change incentives • Trade-off arrangements • Procurement policies • Deposit-refund systems • Take-back systems • Product stewardship • Performance disclosure • Liability law • Performance bonds

sired behavior (waste reduction, improved management, or recycling) rather than penalize the behavior to be discouraged. Subsidies can be direct payments, reductions in taxes or other charges, preferential access to credit, or in-kind transfers like the provision of land or other resources. Obviously these instruments tend to reduce revenues otherwise available to the authorities.

- **Non-Revenue Instruments** such as *deposit-refund programs* combine the incentive effects of charges (when a good is purchased and the deposit is made) and subsidies (when the good is returned or otherwise handled properly and the deposit is refunded) for the management of solid waste. *Other incentive-creating policies* can include *liability laws and performance bonds* (which increase the financial cost of irresponsible waste handling or disposal); *performance disclosure* (in which information about the performance of a waste producer or handler affects its financial condition by affecting public standing); and *general public education* (to alter the demand for environmentally-improved waste management). *Creation or facilitation of markets* is a measure relevant to all parts of the product and waste cycle. Policies to promote more competitive markets in waste management services, instead of the usual direct public administration of waste management, can alter the incentives for participation in the provision of the services; the incentives of the public to rely upon the services, and the fiscal condition of public authorities. Experience with tendering long-term contracts to private service providers illustrates this type of economic instrument.

Table 4 shows the three categories of economic instruments for the solid waste sector used in this paper, with the corresponding subcategories.

Selection of which instruments to implement should depend on the country's solid waste problems and its baseline conditions affecting implementation. Some instruments require more skills to implement than others. Some instruments require stronger judicial systems. Some require competitive private sector involvement by companies able to obtain financing and legal advice, as well as to operate on a level playing field. Some instruments require cost recovery and penalty payment systems that are free of leakage and political interference. Therefore, the instruments in table 4 are not ranked according to any value. No one instrument is consistently more attractive than the others. Nevertheless, lessons learned that provide some perspective on their relative pros and cons are discussed from the literature on case examples.[3] In the conclusion of the report, some will be recommended as immediately appropriate for use in developing countries such as those in Latin America.

[3] Table A at the end of the report provides an overview of the economic instruments that have been applied in the solid waste sector. The table of instruments further lists the various countries where instruments in each subcategory have been implemented. The reference for each case example is provided at the end of the table.

REVENUE GENERATING INSTRUMENTS

Revenue generating instruments include waste generation charges, waste collection charges, disposal charges, and pollution charges. Those instruments that enable charges to be reduced as incentives for recycling or other desired behaviors are also included. Special taxes are instruments that influence disposal choices and deter consumers from products that demand virgin materials, consume non-renewable energy, or create non-recyclable waste. Some revenues go to earmarked funds designed to improve the environment, increase recycling, and cover the costs of remedying contaminated solid waste sites.

The revenues from the various economic instruments discussed below do more than provide the financial support for solid waste improvements, and influence the behavior of waste generators, polluters, and service users. Additionally, a steady stream of revenues influences the interest of the private sector in participating in providing services and encourages private sector investment.

Charges

Direct user charges for waste collection or disposal are easy to implement, providing there is political will. Such charges are useful for generating the necessary revenues to cover costs; and have been successfully applied to substantially recover costs for solid waste collection (e.g., in Tema, Ghana; Surabaya, Indonesia; and Tashkent, Uzbekistan). However, commonly, the charges are set at very low levels and revenues generated are not earmarked to support the solid waste sector. Unless the solid waste service agency is somewhat commercialized, allowed to have an earmarked segregated account, and able to increase charges as needed to recover costs, user charges will not necessarily lead to improvement in solid waste management.

Many high-income countries use the property tax to generate the revenues to cover solid waste costs. In high-income countries that have competent property appraisal and taxation systems, property taxes are a reasonable and efficient way to generate the revenues necessary to cover solid waste management costs, particularly since solid waste services are considered public goods (Cointreau et al. 2000). In the U.S., the choice is left to municipalities, with most charging a fixed rate per household through the property tax, some charging a separate flat rate based on property size, and some charging a variable rate per unit of waste. However, where the property tax collection is not comprehensive, some governments cover solid waste service costs by adding a percentage increase to water or electricity service bills, while others separately collect specific user charges door to door. Examples include Santiago, Chile, where a flat tax is added to utility or property taxes, and which has been able to cover nearly all costs. Colombia and Ecuador allow a flat tax for solid waste to be added to electricity bills, enabling full cost recovery (Huber et al. 1997). However, most Latin American cities have had difficulties in implementing user charges that adequately keep pace with inflation to cover costs, with the result that cost recovery ranges from 10% to 70% (Beede and Bloom 1995).

If the property tax is used to cover solid waste service costs, the amount allocated to the solid waste sector may be shown as a percentage of the total costs, thus making the service delivery entity ac-

BOX 1

EXAMPLES OF REVENUE GENERATING INSTRUMENTS

- **Pollution charges**, based on pollutant loading
- **Waste generation charges**, based on waste quantities and degree of waste hazard
- **Waste user charges**, based on collection and disposal services received
- **Waste tipping charges**, to unload at transfer or disposal facilities
- **Product charges**, fees to handle disposal of problem products, such as batteries, tires, refrigerators
- **Disposal taxes**, added to disposal charges to influence disposal choices
- **Pollution taxes**, added to user charges to influence choices of manufacturing feedstock, fuels, etc. for pollution reduction
- **Eco-taxes**, added to nonrenewable energy production or fuels to influence energy demand and fuel choices
- **Presumptive taxes**, based on presumed levels of pollution
- **Renewable resource taxes**, on virgin materials to influence demand for their use and motivate recycling of secondary materials
- **Subsidy reductions**, removal of subsidies that encourage use of virgin and nonrenewable resources

countable to consumers for its cost. However, in most developing countries, the full cost of solid waste management is not readily apparent. Solid waste costs are difficult to determine, because some costs are not shown in the budget, such as depreciation of facilities and vehicles, pensions, administrative overheads, and debt service. Also, the costs are hidden in a number of places, rather than all allocated to one cost center, such as a solid waste department. For example, it is common for a city within a developing country to have some part of the solid waste budget distributed to districts that provide street sweeping and drain cleaning services, while another part goes to the central workshop that manages the solid waste collection fleet; another part goes to the health department to pay inspectors; and another part goes to the solid waste department that manages the drivers and waste collectors, and possibly some other services such as cemetery maintenance, septic tank and cesspit emptying, and zoo management. To further complicate this scenario, typically there is a veterinary department that cleans the markets and slaughterhouses, and there may be a parks department that separately cleans all public open spaces.

Conceptually, and in isolated examples, variable user charges have been shown to be useful tools to influence the quantity of waste (Beede and Bloom 1995, EPA 1990). However, for most high-income countries, the cost of solid waste service is considered too small (relative to income) for moderate changes to substantially influence behavior. In most high-income countries, the cost for solid waste service is under 0.5% of average income, while it might be as much as 2.5% of average income in poor countries. Nevertheless, Switzerland has adopted the nationwide policy of variable rate charges for waste collection, while most other countries in Europe leave the choice to each municipality (Ecotec 2000). Like Switzerland, South Korea has adopted a nationwide policy of variable rate charges for waste collection (IISD 2002).

For variable rates to influence behavior, the cost of solid waste service needs to be considered by the user as significant. For more wealthy households, the variance in charges may be insignificant relative to household income. For poorer households, the dilemma is to price the rates so that they lead to cost recovery and discourage waste generation, but do not lead to increased illegal dumping (Fullerton and Kinnaman 1996, IISD 1996a).

A variant on user charges is a presumptive charge. Such a charge is based on a specific quantity of waste, requirement for service, or level of pollution. A waste generator must pay this presumed charge, unless it is able to prove through its own self-monitoring that its environmental burden is lower than presumed and thus the charge should be lowered (Huber et al. 1997).

Data from North American municipalities using variant charges indicate that the amount of waste discharged for collection is, in some cases, reduced and the amount of waste recycled is increased. As with water user charges, which requires water meters, solid waste variant charges also have special requirements. Some cities use containers of fixed size and design and base their charges on the number of containers put out for emptying. Other cities use special bags of a given size and sell those bags at prices that cover service costs. Other cities have weighing scales on the truck and computerized systems that weigh and record the weights for automated customer billing.

A few examples of variant user charges are noted below:

- A 1992 study of ten United States municipalities used 32-gallon labeled bags sold at $1.50 each for cost recovery of curbside collection. The variant charge by volume led households to reduce their waste by an average of 18%. When curbside collection programs for recyclables were added, average waste reduction increased to over 30% (Beede and Bloom 1995).
- A 1992 study in Charlottesville, Virginia used a 32-gallon bag sold at $0.80 for curbside collection. The study found that the weight of waste discharged by households was reduced by 14%, while stomping waste into the bags reduced the volume by 37%. The weight of recycling was increased by 16%, but illegal dumping may have accounted for 28% to 43% of the weight reduction in waste placed for collection. It is noteworthy that Charlottesville is a university town with a high level of well-educated residents (Fullerton and Kinnaman 1996).
- Sidney Township in Ontario, Canada, distributed tags for attachment to bags for collection. Initial tags were free and subsequent tags were sold for $1.50 per tag. Within the first year, the Township experienced a 42% reduction in the weight of waste taken to landfill, and a 44% increase in the amount of waste recycled. Waste composition studies showed that the total capture of recyclables was 83% (Gale 1996; IISD 2002).
- The Victoria Capital Regional District of British Columbia, Canada, raised landfill tipping fees

seven-fold over the 1988-1993 period for the express purpose of discouraging landfill (IISD 1996b).

Conceptually, the above examples show that charges, if established on a variable rate basis, can influence consumer and producer behavior to reduce and recycle wastes. However, the added complexity and cost of administering a variable rate charge system needs to be weighed against the potential benefit, especially given the relatively low waste generation rate and high recycling rate already found in most developing countries.

Taxes

Besides charges, revenue generating instruments include special green taxes (also called eco-taxes) designed to influence consumption, waste generation, waste reuse, and pollution. When the consumer pays eco-taxes on products, these taxes are expected to motivate consumers to reduce consumption, and consumption is the main factor driving waste generation. When industries pay eco-taxes, the result will largely influence their fuel choices and emission levels. Consumer-based taxes appear to be more common than industry taxes. Some eco-taxes boost the cost of a natural resource, such as an oil or forest resource, resulting in less waste and more recycling of that natural resource.

The tax on wood consumption implemented in Colombia, Brazil and Venezuela is one example (UNEP 2002). Taxes such as this one may also have secondary effects. While the wood tax is meant to preserve forests by limiting their degradation, it also has the effect of driving up the cost of wood and thus encouraging the recycling of wood-related products such as paper. Other eco-taxes are placed on products or on packaging for the purpose of encouraging recycling and limiting waste. In Hungary, a packaging tax was implemented in 1996 after 3 years of negotiation between industry, trade organizations and environmentalists. The tax is levied at the point of either sale or import. Tax revenues are generally earmarked for an extra-budgetary environmental fund related to packaging. For products with eco-labels that indicate recycling or product take-back, the tax is discounted (IISD 1996a). In Europe, the eco-taxes on non-beverage packaging are generally weight-based, and companies can reduce their tax costs if they keep their packaging lightweight.. Also, eco-taxes on packaging are adjusted if the packaging is made from recycled material; for example, non-beverage packaging made from recycled paper or cardboard is taxed at a lower rate (EUROPEN 2000). In both Estonia and Hungary, companies are exempted from various kinds of packaging eco-taxes if they are able to prove that the packaging is collected, reused and recycled, either through take-back or through a licensed recycling program (like Germany's Green Dot) (EUROPEN 2000). Other examples include Latvia, which has implemented eco-taxes on batteries, disposable containers, and tires (Speck and Ekins 2000). Most European countries have eco-taxes on various packaging materials and wastes, which, in some cases, generate significant portions of total country tax revenues (Klarer et al. 1999).

Revenue Potential

Detailed data from the Organization for Economic Co-operation and Development (OECD) show that green taxes in OECD countries averaged 2% of gross domestic product and 6% of total tax revenues in 1998. On a per capita basis, they were as high as $1,700 per year in one country (Denmark), but typically from $200-$800 per capita in most OECD counties (OECD 2001). Denmark was one of the first European countries to create eco-taxes on non-beverage packaging (EUROPEN 2000). By 1999, Denmark also had eco-taxes on a wide range of environmentally significant items, including pesticides, fertilizers, tires, waste oils, waste lubricants, and refrigerants (IISD 1996a).

Use of Revenue

Most eco-taxes in Europe embrace the view that the level of the tax should cover the full costs of environmental externalities so that the polluter pays for all environmental damages and resource depletion. A 1998 study group on carbon taxes in Japan found that a high carbon tax would lower energy consumption, but could also adversely affect Japan's gross domestic production. Therefore, the study group recommended that a low carbon tax rate was preferable for Japan. The study surmised that the carbon tax would involve everyone in paying for environmental improvement and heighten awareness about energy conservation, while emissions trading would be a better cornerstone of Japan's carbon dioxide emissions reduction program (IISD 1996a).

In a number of European countries, not all of the money generated through economic instruments is needed for purposes of environmental improve-

ment. Eco-taxes are increasingly being set at high levels to discourage waste generation and pollution, and surplus revenues are being applied to reduce other taxes. For example, in the United Kingdom, the surplus income from waste and energy taxes is applied to reduction of the social security contributions that employers pay; France is targeting the surplus income from pollution taxes to support the introduction of a 35-hour work week. Sweden is earmarking the revenues from fuel and energy production toward training and other activities to support employment creation; and Italy's carbon dioxide tax revenue is allocated at 60% for social security, 31% for compensation measures and 9% for energy saving and environmental improvement (Speck and Ekins 2000).

There is considerable debate in Europe about whether shifting the tax burden from labor (i.e., income tax) to pollution (i.e., eco-tax) encourages more work effort (OECD 2001). One study documents the estimated job-creation impacts from environmental tax shifting in Australia, United Kingdom, Germany, and France (Green Dot Canada). This "double dividend" of economic and environmental improvement through eco-taxes needs careful assessment in each country. While it may be important in European countries known for their very high income taxes, it possibly has little relevance in North America or most developing countries, where income taxes are more modest.

Enforcement and dumping

In order for landfill tipping fees and taxes to motivate reduced waste disposal, the illegal dumping vigilance and enforcement systems need to be particularly competent. In the United States, the transport of wastes between states to the lowest-priced landfill within a viable truck or rail transport distance is generally unhindered, indicating that pollution control is being conducted where it is most cost-effective. However, strong enforcement of truck loading and pollution control compliance in some states may affect transportation to or through those jurisdictions. In 1992, the United States Supreme Court decided that the state of Alabama was in violation of commerce laws when it implemented higher tipping fees for wastes being imported from outside the state (Duer 1995).

Eco-Tax and Trade

Border tax adjustments may address trade competitiveness issues. As an example, the U.S. levies taxes on ozone depleting chemicals, based on the type of chemical and its weight in the product. The tax is levied on U.S. manufacturers and importers. Border tax adjustments are made when products containing these chemicals are exported (OECD 2001). Similarly, South Korea has eco-taxes on 15 types of products that create waste management problems (e.g., batteries, florescent lamps, disposable diapers, pesticides); but it does allow exemption when such products are made for export (IISD 2002).

Eco-taxes, however, are often argued by one party to constitute an unfair trade barrier. In the European Union, for instance, there has been considerable debate over whether the eco-taxes implemented in some countries (particularly Denmark and Netherlands) are cost-effective. The European Organization for Packaging and Environment (EUROPEN) has taken the position that "eco-taxes on recoverable packaging and the exemption criteria associated with them constitute an unjustified trade barrier," that "market share quotas for refillable beverage containers serve as quantitative restrictions on imports," and that "although eco-taxes and exemption criteria apply equally to imported and home-produced goods, the effect is discriminatory since any refill obligation will be easier for local manufacturers to meet."

Experiences with Eco-Taxes Directly Related to Solid Waste Management

One of the greatest solid waste problems is created by the extensive use of disposable plastic bags. These bags are not recyclable and they tend to become readily windblown at land disposal sites and during waste transport. The problem is particularly acute in developing countries, where there is open dumping and these wastes are not covered to minimize dispersion by wind. A devastating problem seen in many developing countries (e.g., Morocco, Mauritius, India) is that cows grazing on nearby lands are prone to choking on these windblown bags, with significant mortality resulting. Italians found that thin-film plastic bags were an eyesore on their resort beaches and also led to the choking deaths of dolphins. Italy introduced a tax on plastic bags in 1989 and gradually increased the tax until it became about five times greater than the manufacturing cost of the bag. In three years the revenue from the bag tax generated the equivalent of about $US 150 million (IISD 2002). Similarly, the Irish government placed a heavy tax on plastic bags in 2002, which resulted in a sharp

(90%) decrease in consumer demand (Environment Daily 2002).

Landfill is usually the lowest-cost method of waste disposal, and may be half the cost of composting and 10%-20% of the cost of waste-to-energy (Cointreau et al. 2000). Therefore, special taxes or elevated tipping fees for landfill disposal are a means of directing waste toward recovery. France, Italy, the United Kingdom and the Netherlands have a landfill tax; moreover, the Netherlands has implemented a ban on including used packaging in landfill, with certain exemptions (EUROPEN 2000). The landfill tax in France has been earmarked since 1993 for a national fund to promote innovative means of waste treatment, to finance the upgrading of landfills, and to remedy contaminated sites (IISD 1996c). Similarly, in 2002, the U.S. state of Pennsylvania passed a new law to allow a landfill tax to be charged on most incoming wastes, excluding those used for alternative daily cover. Pennsylvania's landfill tax is meant to encourage increased waste minimization, recycling and recovery. It is earmarked for an environmental fund, which had already been created for an earlier landfill tax that would specifically support watershed protection. A separate tax is charged on all wastes for the purpose of financing a recycling fund.[4]

Charges Versus Taxes

In setting disposal user charges (i.e., landfill tipping fees), the question arises whether disposal user charges should be based solely on costs, or whether an eco-tax or surcharge should be added to drive disposal decisions towards giving preference to one technology over another. In 1999, the United Kingdom announced several tax reforms to help protect the environment, including an increase in landfill taxes to persuade local governments to pursue alternatives to landfill (UNEP 2000). Landfill tipping fees in the U.S. are not entirely based on cost. Rather, landfill fees are driven by market demand and landfill availability, because most U.S. landfills are privately owned and operated. Each landfill owner bases the price on his or her own needs to either increase cash flow in any given year or extend landfill capacity.

Subsidy Reductions

There are numerous hidden subsidies in the arena of solid waste services, wherein central governments provide municipalities with subsidized loans, seconded staff, exemptions from customs duties on equipment, and land for disposal sites. One way to stimulate private sector participation in service delivery is to put local governments' solid waste departments on the same level as the private sector by eliminating subsidies and encouraging them to compete through managed competition. This has been effectively conducted in a number of cities in the U.S., including Phoenix and Glendale in Arizona, and has resulted in significant cost savings.

Most countries in the OECD have reduced or eliminated subsidies for energy production. For example, the United Kingdom, Belgium and Portugal removed their subsidies for coal production (OECD 2001). Studies in Russia in the mid-1990's showed that the reduction of government subsidies on energy reduced pollution more than introduction of pollutant taxes (Huber et al. 1997). It warrants further study whether the same might be true for subsidies of natural materials used as raw input for manufacturing, such as forest materials. While the raw material might not be subsidized specifically, there could be subsidies for transport, and others for land management or land leasing.

REVENUE PROVIDING INSTRUMENTS

Revenue providing instruments seek to change behavior by stimulating the private sector to improve its environmental performance. This category of instruments includes a variety of examples, as summarized in Box 2, of instruments that affect waste generators, waste managers, and product or process developers—for example, instruments that encourage investment in improved solid waste services or new solid waste technologies.

Tax Credits

Private service companies make many of the major investments for transfer, treatment and disposal facilities. Because these private companies pay taxes, government can use tax-related instruments (such as tax-exempt debt, tax credits, accelerated depre-

[4] This is according to information shared by officials in Philadelphia and Pennsylvania government during interviews for this report by engineer Nancy Cunningham, 2002.

ciation) to encourage investment, as outlined in the examples below:

- In the U.S. during the '70s and '80s, the federal government created tax benefits for publicly or privately-owned waste-to-energy incineration facilities, as well as regulatory requirements for the purchase of the resulting energy.
- Thailand reduced import duties for pollution control equipment, including equipment used for solid and hazardous waste disposal, thereby limiting the investment risk for the private sector.
- In the UK, legal reform arranged recycling credits for businesses that collect and recycle waste so that municipal waste collection and disposal could be avoided. Credits are calculated as a percentage of the collection and disposal avoidance costs and thus ensure some income for recycling businesses, even when the market demand for recyclables is low (IISD 1996a).
- The Netherlands created an Energy Investment Relief Scheme in 1997 that allows a substantial tax credit for investments in energy development from renewable resources such as solid waste, as well as investments in energy efficiency (Biomaster 2000).
- Ghana provided incentives of accelerated depreciation and exemption from customs duties to encourage investment by some private operators that entered the solid waste collection business.

Development rights and property rights

Economically valuable development rights can provide a powerful motivation for private sector investment in waste site improvement. In 1993, solid waste disposal at Manila's huge open dump, called Smokey Mountain, was stopped due to local and international public pressure. The company selected to close and reclaim Smokey Mountain, as well as build a new, modern solid waste treatment/disposal facility on one portion of the site, would receive development rights for the reclaimed land, including about 80 acres of newly created adjacent land in Manila Bay.

Host community compensation

State laws in the USA allow governments to compensate host communities that allow solid waste facilities to be built and operated within their boundaries. Compensations may include direct payment and the sharing of landfill revenues, as well as the right to discharge their own waste at the facility at reduced cost. In the Philippines, the metropolitan government has provided host communities with new roads and landfill revenue sharing.

BOX 2

EXAMPLES OF REVENUE PROVIDING INSTRUMENTS

- **Tax credits and tax relief**, allowances on property taxes, customs duties, or sales taxes to motivate investment in waste management improvements
- **Charge reduction**, based on proof of recycling or reuse in reducing wastes requiring collection or disposal
- **Tax rebates**, for pollution savings or energy efficiencies
- **Environmental improvement funds**, established to support pollution reduction, resource protection, energy efficiency
- **Research grants**, to stimulate technology development
- **Carbon sequestration funds**, to encourage purchasing lands that rejuvenate the air quality, sometimes as a trade-off by polluters
- **Host community compensation**, incentives given by host communities to allow waste transfer or disposal facilities to be built there
- **Development rights**, long-term leases of land and development rights provided to private companies building waste treatment and disposal facilities, or to those remediating and reclaiming old disposal sites

Funds for Site Remediation

The topic of revenue providing instruments includes the various types of funds that influence environmental improvements at waste sites. One notable example is the U.S.'s Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly referred to as Superfund. CERCLA provides the U.S.'s Environmental Protection Agency's (EPA's) Office of Emergency and Remedial Response with the authority to respond to releases or threatened releases of hazardous substances, pollutants, or contaminants that may endanger human health or the environment.

NON-REVENUE INSTRUMENTS

Non-revenue instruments are essential to solid waste management. A city cannot be clean if its people and establishments do not cooperate with the solid waste services provided. If people litter or put their waste containers at the curb in a disorderly manner or at the wrong time for the scheduled collection, the city will look dirty, regardless of whether the waste collection system is adequate. Simple instruments like neighborhood cleanliness competitions and clean-up campaigns have proven to motivate change in countries as diverse as Indonesia, Ghana, and Nigeria.

Some non-revenue instruments inspire reduced waste generation and increased recycling. These include deposit-refunds, producer take-back systems (also referred to as product stewardship or extended producer responsibility), and eco-labeling. There are a number of instruments that are specifically designed as disincentives against pollution, including liability laws for environmental damages, waste manifest systems, and polluter blacklists.

The solid waste sector relies on the cooperation and motivation of various stakeholders, including consumers, producers and service providers. In developing countries, where government access to capital is limited, every effort to stimulate private sector investment and participation is essential. Thus, procurement policy changes, labor law revisions, and management competition can promote solid waste service improvements.

Product and Production Change Incentives

In 1996, source reduction methods in the U.S. resulted in an 11% reduction in waste quantities generated. The main methods causing successful waste quantity reduction were: lightweighting (thinner and lighter paper and cardboard), materials replacement (plastic for glass bottles), electronics reuse, composting of yard wastes and kitchen scraps, mulching lawnmowers and wood chippers, and reuse/repair of wooden pallets.

Examples of lightweighting initiatives include:

- Coca-Cola reduced the weight of its soda can by 41%;
- Proctor & Gamble reduced the weight of its vegetable oil plastic containers by 30%;
- Federal Express reduced the weight of its envelopes by 40% (EPA 1999).

One way to increase investment in recycling is to specify recycled content. Some U.S. states have done this for a wide range of recyclable materials, as noted in the examples below:

- California requires 50% recycled content in newsprint, 65% in glass containers, 10% in 1.0 mil plastic bags, 30% in 0.75 mil plastic bags, 25% in durable plastic containers;
- Connecticut requires 50% recyclable content in newsprint and 40% in telephone directories, leading to most telephone companies implementing a take-back system;
- Oregon requires 50% recyclable content in glass bottles, 25% in newsprint, 25% in durable plastic containers (Macauley and Walls 1995).

In most countries, city, provincial and national governments together comprise the largest consumer. Thus, if they rewrite their procurement specifications to favor products with more recycled content, this can dramatically drive up the market demand for recyclable materials. This method of increasing recycling became the driving force for most U.S. states, with some examples noted below:

- Arkansas gives 10% price preference to bidders for recycled paper products and requires 60% of paper purchases to be recycled paper;
- Colorado gives 5% price preference for goods with at least 10% recycled plastic and requires 50% of paper purchases to be recycled paper;
- Indiana gives 15% price preference for products containing at least 50% recycled content by volume;
- Pennsylvania gives 5% price preference for purchase of recycled products (Macauley and Walls 1995).

Similar to the other U.S. states noted above, New York provides a price preference for recycled products (e.g., 10% on recycled paper). It has also extended its revision of procurement specifications into its construction practices. One noted example is its requirement for crushed glass to be included in repaving material by all New York road maintenance contractors. The streets of New York now glisten with the glitter of “glassphalt.”

Banning certain materials or constituents from disposal influences production changes and waste management practices. Because of the waste disposal problems related to batteries containing mercury, a

BOX 3

EXAMPLES OF NON-REVENUE INSTRUMENTS

- **Product life cycle assessment** predicts overall environmental burden of products and can be used in certification programs
- **Deposit-refund**, deposit paid and refund given upon product return for reuse
- **Take-back systems**, manufacturers take back used products or packaging
- **Tradable permits** allow trading of emissions among various polluters
- **Bans** on materials or wastes causing disposal problems, such as thin-filmed plastic bags, mercury batteries
- **Procurement preferences**, evaluation criteria adding points for products with recycled content or reduced resource demand
- **Eco-labeling** notes product's recyclable content and whether product is recyclable
- **Recycled content requirements**, laws and procurement specifications noting the precise recycled content required
- **Product stewardship** encourages product designs that reduce pollution, include the full cost of solid waste recycling and disposal, reduce wastes and encourage recycling
- **Disclosure requirement**: waste generators are required to disclose their pollution
- **Manifest systems**, precise cradle-to-grave tracking of hazardous wastes
- **Blacklists of polluters**: published lists enable consumers to consider whether to buy from polluting companies
- **Liability insurance**, liability assurances by contractors and private operators
- **Bonds and sureties**, guarantees for performance by contractors and private operators
- **Liability legislation**, laws defining environmental restoration settlements
- **Insurance pools**, restructuring of insured parties to enable pollution risks to be covered
- **Liens** placed on land where government remediation is required
- **Procurement transparency and competition** to encourage bidding on a level playing field
- **Managed competition**: enables equitable competition between public and private sector
- **Performance-based management contracting**: oversight contractors commit to overall service improvements
- **Clean City competitions** reward neighborhoods and cities that have improved cleanliness

number of states in the U.S. (including California, Minnesota, New York, Connecticut, Oregon and Vermont) have banned all production of batteries containing mercury (IISD 2002). A number of products are banned from landfill in the U.S. Each state determines which products to ban. Some examples are:

- North Carolina bans lead-acid batteries, beverage cans, tires, oil, sludge, antifreeze, white goods and yard waste;
- South Dakota bans lead-acid batteries, motor oil, white goods, rigid plastic containers, glass and metal containers, corrugated boxes, paper packaging, and yard wastes;
- Oregon bans lead-acid containers, tires, motor oil, white goods, and motor vehicles;
- Connecticut bans lead-acid batteries, motor oil, scrap metal, corrugated cardboard, newspaper, glass food containers, metal food containers, and white office paper (Macauley and Walls 1995;
- Twenty-four states in the U.S. ban yard wastes from being disposed of in landfills (Fickes 2002).

Trade-off Arrangements

When government allows pollution trading or emission offsets, it creates a market for emissions. For example, one company may purchase the emission savings accomplished by another company. Or, within a company, some emission sources are reduced while others are not, so long as the overall pollution bubble for the plant meets an acceptable level. Through pollution trading, market forces would lead the emission savings to be achieved at the location that can do so in the most cost-effective manner.

The concept of tradable permits in other contexts is not new. The U.S. developed one of the earliest trading programs in 1983 when it allowed lead emissions to be traded and credits to be saved for future trade. Santiago, Chile, has had a system of tradable air permits since 1991, wherein the initial permits were distributed free of charge and new sources had to obtain their permits from existing sources. By 1993, pollutants from fixed sources were estimated to have been cut in half (IISD 1996a). The U.S. has been allowing trading of quotas for ozone-depleting chemicals since 1989. A total of 321 million kilograms of these chemicals (561 trades) were made between 1989-1995 (OECD 2001). California law has supported nitrous oxide and sulfur dioxide emission trading since 1994.

The solid waste sector is beginning to enter the tradable permits arena for air emissions. Examples include:

- In the summer of 2000, a variation on pollution trading was implemented to increase badly needed electrical power generation in southern California. Pacific Gas & Electric utility in San Diego wanted to build a large new generating plant but regulation required that its new emissions be offset by reductions from other sources. A waste hauling company, Waste Management, Inc., replaced 120 of its conventional diesel-powered trucks with liquefied natural gas (LNG)-powered trucks, which are cleaner burning and therefore provided the necessary reduced emissions.
- In the UK, all manufacturers of packaging must obtain certificates to show that they are meeting specified targets for reprocessing of their packaging. Surplus certificates can be traded, which is intended to motivate reprocessors to expand capacity beyond required targets (EUROPEN 2000).
- Ho Chi Minh City in Viet Nam recently applied for air pollution remediation of its landfills to be traded for air emissions in the Netherlands.
- In 2002, the World Bank's Prototype Carbon Fund (supported by donor countries and private firms) financed methane capture and electricity generation for landfill gas recovery from a municipal landfill in Liepaja, Latvia. Grant financing of the gas recovery raised the project's estimated rate of return from 2.6% to 22% (World Bank 2002).

Procurement Policies and Private Sector Involvement

For major progress in the solid waste sector, developing countries will need to restructure their involvement of the private sector. To date, most private sector investment in developing countries involves short-term and small-scale contracts for waste collection, where costs are lowered primarily because low-cost daily workers are used. Local procurement laws commonly limit long-term contracts for solid waste services. With contracts of only 3-month to 1-year duration (e.g., in Indonesia, India, Bangladesh, Pakistan), investment in equipment and facilities cannot be depreciated in a way that enables low-cost service delivery (Cointreau et al. 2000).

Procurement changes include leveling the playing field for the private sector to compete for solid waste service contracts and encouraging the private sector to build and own its own solid waste processing facilities. Contracts with durations long enough to write off depreciation over the economic life of investment, precise clauses of performance measurement, and open public tendering provide ample incentives to private operators to invest in solid waste equipment and facilities (Cointreau et al. 2000).

- Sekondia-Takaradi, Ghana, and Islamabad, Pakistan, allowed leasing of city-owned waste collection trucks to enable private operators to enter the business of solid waste collection without immediately having to make significant investments in new, specialized equipment.
- Chennai, India, and Jakarta, Indonesia, tendered waste collection contracts with several years of duration to enable adequate depreciation of investment by private contractors.
- Hong Kong and Jakarta, Indonesia created competitive tenders for build-own-operate concession contracts of 15–20 year duration for solid waste transfer facilities.
- Guayaquil, Ecuador, held a highly competitive and transparent international tender for construction and operation of a new sanitary landfill, with resulting low landfill costs due to the strong competition and favorable foreign export credits received.
- South Korea built a government prototype hazardous waste treatment facility and offered licensing for the private sector to build comparable and competing privately owned facilities, while requiring all industries to bring their hazardous waste to a licensed facility. Within several years

there was a highly competitive market in hazardous waste treatment and disposal provided by the private sector with competitive contestability from the government's own facility.

Strong laws that require safe disposal can provide powerful stimulation for private sector investment in disposal. The stringent laws passed in India in 1999, following a Supreme Court decree that solid waste improvement must be carried out, required organics to be composted and all other wastes to be recycled, treated or placed in sanitary landfills. These new laws, coupled with the understood enforcement commitment of the Supreme Court, have encouraged significant investment in biomedical treatment, composting, refuse-derived fuel, and other methods of disposal, with private companies from all over the world making substantial investments in new privately owned and operated facilities (India 2000).

Labor laws can sometimes interfere with the goal of increasing private sector investment in waste management. Many Latin American cities have high severance pay costs associated with reducing government roles. There is no net gain to city employment if solid waste work is simply shifted to another sector in order to avoid labor reduction costs. In Quito, Ecuador, as lucrative private sector job opportunities were created in the solid waste sector, the city offered an incentive severance package. For younger employees with few years vested in retirement, the package and the new opportunities for employment in the private sector led to voluntary departures. Over time, the roles were further reduced by a freeze on hiring and by natural attrition.

Cities in India are not permitted to dismiss employees when they privatize. Therefore, involving the private sector does not lead to a reduction in government roles and corresponding reduction in government costs. A number of cities have imposed a freeze on hiring and try to find useful work for the now-older work force, such as work as communal container attendants. Because government laborers make 3 to 4 times more than private sector laborers, this issue has a dramatic impact on costs and the ability of cities to lower costs.

There is a requirement under the Labor Act that cities are required to hire workers if they are used for more than 240 days to do routine tasks. Therefore, solid waste collection contracts with the private sector are typically for only 240 days or less. In Hyderabad, there are more than 100 contractors, each with one or two open trucks, and most renting their equipment. When each contractor ends one contract and begins another, it leaves the labor of its area of service in place, and takes on the labor present in its new area of service. The contractors therefore have no long-term responsibility to their laborers.

In a slightly different approach, in Bangalore, India, the contractors swap laborers so that their contract periods can last more than 240 days, arranged through contract extension. In Bangalore, motivation for change is being driven bottom-up, rather than top-down. The first major motivator occurred when the city was taken to court over its poor disposal practices. But even with court-ordered improvement requirements, Bangalore's current high level of achievement would not have been likely if industry hadn't stepped in to provide significant technical and financial assistance. Industry leaders organized an international study tour and conference to learn what works in improving solid waste and then began a public-private campaign to change behavior and implement replicable models of improved systems. The successful computer technology industry based in Bangalore was willing and able to underwrite a significant level of this effort, and placed considerable pressure on city officials to undertake long-term sustainable improvements.

Deposit-Refund Systems

Deposit-refund systems are applicable to only certain types of wastes, particularly those that maintain their integrity after use and are readily recyclable. For uniquely recyclable products or packages, deposits can be paid upon initial purchase and refunded when the packages or products are returned. Beverage containers are commonly managed through deposit-refund systems. Glass and aluminum beverage containers are easy to clean and return for refunds. Tires and car batteries are increasingly being managed through deposit-refund systems. While they are heavier and more cumbersome for a consumer to handle, the consumer typically goes to specialized service stations to have them replaced, and thus the system is convenient. Most deposit-refund systems are voluntary and need to fit with the concept of consumer convenience. However, compulsory systems do exist for some special hazardous wastes. For example, Mexico does not allow the sale of a car battery replacement unless the old one is returned (Huber et al. 1997).

Deposit-refunds are useful economic instruments because they dramatically reduce waste generation with regard to the unique products or packages that

apply. Deposit-refunds that are industry managed are used directly to cover recycling costs. The deposit-refunds for beverage containers are voluntary and charged per unit; they are not weight-based and their unit charge tends to be based on the volume of liquid contained and the material from which the container is made. Belgium additionally created an exemption ruling that beverage producers that do not have refillable containers would have to pay an eco-tax (EUROPEN 2000).

Deposit-refunds on beverage containers have been widely implemented in the U.S., with all markets selling beverages required to have a take-back system and pay refunds. Most states also require distributors to pay about 20% of the value of the returned beverage container to the state as a handling fee (Macauley and Walls 1995).

In Europe, each country's economic instruments are required to respect the competition provisions of the European Union Treaty and support objectives of free market access (Duer 1995). In 1988, there was a court dispute over Denmark's implementation of a deposit-refund system for beer and soft drinks bottles. Also, Denmark required local beverage producers to use refillable bottles, thus essentially banning local producers from using beverage cans. Other European countries argued that Denmark's requirements discriminated against imports of beer and soft drink from other countries, except for those that produced their product in recyclable bottles. Denmark won the case because it had such a successful recycling rate, 97%, and the court determined that the deposit-refund systems was a crucial factor in its success (Duer 1995). By 2001, reports showed that that beverages in local refillable bottles made up 99% of the Danish market (EUROPEN 2000). In 2002, Denmark responded to the pressures from other countries and ended the ban on beverage cans (Environment Daily 2002a).

Take-Back Systems

Plastic wastes have serious environmental consequence. Every 1 kg of plastic production requires 2 kg of oil. If plastic is put into a landfill, none of this fuel equivalent is recovered. If it is incinerated for energy recovery, it is possible to recover no more than 0.5 –1.0 kg of oil equivalent energy. Recycling recaptures nearly all of the 2 kg of inherent energy value, in terms of avoided energy requirement in generation of new plastic. After noting that only 2% of its plastic waste was recycled in 1998, Norway implemented a producer take-back system, with the goal to have full recovery by 2010 (Sundt and Oland 2002). While this Norwegian take-back system is compulsory, it is not purely a command approach because it has the effect of influencing producers to use other materials that might be more recyclable.

Producer take-back systems initially focused on recovery of packaging. Under German packaging regulations, initiated in 1991, producers are required to take back and recycle specified portions of their packaging and submit audited reports to prove their targets have been met. Take-back in Germany could be avoided only if a packaging producer arranged for licensed recyclers to recycle their packaging, and correspondingly showed this by placing the Green Dot trademark on the product. For foreign companies to meet the German standards, either they provided take-back transportation for their own packaging or they could hire a German firm to package their product (EPA 1997). The Green Dot program expanded to include at least 10 European countries, with special licensing of the trademark to them, and also to Canada (Green Dot Canada). In 2001, the European Union decided that restriction of trade was occurring because of the Green Dot requirement and required Germany to allow comparable recycling trademarks and recycling systems to be used (Commercial Angles 2001; Zwick 2001).

Now producer take-back systems are reaching beyond packaging, particularly to electronics and automobiles, following a proposed directive by the European Union. While these take-back programs have proven, in Germany, to reduce waste disposal, they have been expensive because of the additional transportation requirements of returning used products to producers. British Columbia, Canada, began a program of product take-back beginning in 1992 by requiring all sellers of oil to take back used oil, at no charge to the consumer, for recycling. In 1994 the province decided to apply product take-back to waste paint, solvents, thinners, fuels and domestic pesticides, which together comprised 94% of the household hazardous waste stream (British Columbia 2001). In 1997, British Columbia drafted new enabling legislation to further extend product take-back, including pesticides, gasoline, solvents/flammable liquids, beverage containers, and pharmaceuticals. The expanded program allowed industry associations to establish their own eco-fees to be added to their product prices and enabled them to earmark those fees for an administrative fund managed by each affected industry association.

The U.S. does not mandate producer take-back. Nevertheless, a number of firms are conducting product take-back to avoid disposal costs and/or save on production costs by remanufacturing recovered products, including Kodak (single-use cameras), Xerox (photocopying machines), Hewlett Packard (laser toner cartridges). Two examples of waste reduction are:

- Kodak achieved 85% reuse of its single-use cameras through a take-back program with film developers;
- Maytag reduced refrigerator packaging by 84% by switching to returnable packaging (EPA 1999).

Product Stewardship

The Solid Waste Association of North America (SWANA) has conducted several forums with trade associations (such as those for plastics, scrap metal, electronics) to develop a policy of promoting product stewardship. Under the policy, incentives for product stewardship are being encouraged. This could involve procurement policies by governments, that include procurement preferences related to product stewardship. The SWANA policy calls on manufacturers to use product stewardship to reduce the adverse impact of their products and to include the cost of waste minimization, recycling, and disposal in their product pricing. Product stewardship is not mandatory in the U.S. and Canada, but some industries are now cooperating with this policy. The following topic of Performance Disclosure includes examples of companies in the computer industry being ranked on criteria addressing product stewardship (SVTC 2001).

Performance Disclosure

Environmental report cards by independent organizations have proven to motivate change, as the following examples illustrate:

- After the Silicon Valley Toxics Coalition implemented its Annual Computer Report Card, IBM and Hewlett-Packard began computer take-back programs in the US (SVTC 2001).
- The U.S. government pays an independent non-government non-profit institute to develop and publish a report card on waste reduction record-setters. The list reports on successful recycling and waste minimization efforts conducted by municipalities, government agencies, and businesses (ILSR 1998).
- Colombia formed the Colombian Business Council for Sustainable Development which publishes an annual report on its members' social and environmental performance (Correa 1998).
- Canada monitors the transboundary movement of hazardous and non-hazardous wastes, including imports and exports, and publishes the information annually. Monitoring showed that Canada's hazardous waste imports for landfilling were reduced 29% by weight from 1999 to 2000, following the strengthening of pretreatment standards prior to waste being allowed in landfills (Environment Canada 2001).

Solid waste systems are heavily dependent on trucks to collect and transport waste. Pennsylvania implemented a law, called the Waste Transportation Safety Law, which requires all haulers of waste to obtain and display an authorization sticker. A wide range of environmental compliance and transport safety requirements must be met to receive the sticker. No waste hauling vehicles without the sticker are allowed in Pennsylvania's solid waste transfer, treatment and disposal facilities.[5] Public pressures in San Francisco, California, motivated one private hauler to buy new trucks that run on natural gas, rather than diesel or gasoline. Resulting emission reductions due to this fuel switch are estimated to be about 35% nitrogen oxide reduction, 60% particulate reduction, and 20% carbon dioxide reduction (Siuri 2002).

Blacklists of polluters significantly pressure them to make environmental improvement, given that such lists encourage consumers to boycott polluting companies. The World Bank publishes a blacklist, updated annually, with the names of national and multinational firms that have been involved in corrupt commercial transactions. Transparency International publishes summary briefs about the corrupt and unethical practices of firms (Transparency International 1999). A number of these corrupt firms are also prone to poor environmental performance. Other blacklists, targeted specifically at environmental performance, have had considerable clout in exposing the environmental damages caused by irresponsible oil companies such as those working in Nigeria that allowed massive spillage of oil onto land around drilling rigs (Multinational Monitor 1995, Environmental Watch Ireland).

[5] This is according to information shared by officials in Philadelphia and Pennsylvania government during interviews by engineer Nancy Cunningham, 2002.

While a polluter blacklist is relatively easy to implement, litigation-oriented approaches require good analytical abilities to establish blame and negligence, as well as strong legal systems. However, when private contractors or operators post performance bonds or other types of assurances, court involvement might be avoided and collection for damages would likely be easier.

Most environmental report cards and polluter blacklists are published on the Internet. Waste exchange networks also operate using the Internet. Other information now readily accessible through the Internet has widely enabled people to find ways to recycle. In the U.S., people can learn how to recycle their old computer equipment by visiting the website of the National Recycling Center (SVTC 2001). For industry, waste exchange networks have dramatically enabled manufacturers to sell their wastes as feedstock to other manufacturers. The U.S. Environmental Protection Agency maintains a website listing waste exchanges available nationally and internationally for a wide range of wastes, and also separately lists state-wide waste exchanges that focus on receipt and exchange networking of the wastes within certain states.

Liability Law

Liability laws have traditionally addressed damages to people and goods. Typically these laws have related to a specific incident and required proof of calculable damage and the assignment of blame. More recently, liability laws have also addressed the clean-up of contaminated disposal sites, wherein blame is established even though parties causing the pollution may have been following the existing regulatory framework at the time of disposal. After the Bhopal disaster caused by toxic emissions from a chemicals factory, India required environmental liability insurance for all companies using hazardous substances, which would pay compensation to victims without the need for court hearings to assign blame.

In most of the world, liability laws for damage to nature are not available. Norway, Sweden, and Germany have enacted laws that provide a basis for claiming compensation for environmental damage. Recent oil spills off the coast of Spain have caused such severe damage to nature that the European Commission is considering new liability legislation to hold polluters responsible for environmental damage. In the year 2000, a policy paper for the European Union proposed that new environmental liability laws should apply to all European Union countries.

There are numerous opportunities for lawyers involved in drafting contracts for solid waste facilities to introduce economic instruments. The following material provides some insight on just one topic of environmental need, i.e., closure and post-closure financial assurances. The United States (as well as its individual states) requires that public and private owners and operators of landfills provide financial assurance that they can fund the closure and post-closure maintenance of sanitary landfills and any corrective action in accordance with laws and regulations in an environmentally responsible manner (See for example, U.S. law 40 CFR Sections 258.70 through 258.74.). Available options are listed below, together with observations on relative cash management (dis)advantages:

- *Trust Funds* of cash held by banks in specified fund balances based on estimated costs, adjusted for inflation. Trust funds are the most certain assurance. A trust fund must be fully funded by the time of closure. But law may limit its permitted investments. It may involve payment of trustee fees not incurred under other options, such as an enterprise fund.
- *Surety Bonds* issued by acceptable companies for either performance or payment. From a regulatory or security perspective, bonds are less desirable than trust funds. Sureties may cancel bonds if the credit of the owner/operator deteriorates, since the surety looks to the owner/operator to repay draws on the bond. In that event, the owner/operator likely does not have the credit or cash to secure alternate financial assurances. But from a cash management perspective, bonds may be more desirable than trust funds. Prudent but discretionary reserve funding in anticipation of possible bond repayment may provide opportunity for broader investment than trust funds. Discretionary funding may be back ended, which may better maximize the time value of money than a trust fund with larger up-front mandated payments.
- *Insurance Policies,* unlike open-ended liability policies, have finite risk for estimated costs. Some larger owner/operators may use insurance from captive insurers, which may make them vulnerable to economic downturns of the owner/operator. The present value of trust fund deposits may be less than the present value of premiums, resulting not only in shifting risk to

the insurer but better cash management. There may be tax advantages to insurance: premiums may be deductible and allow the owner/operator to remove closure /post-closure liabilities from its balance sheet.

- *Letters of Credit* in the form of irrevocable standby. As in surety bonds, the bank issuing the letter of credit may refuse to renew it in the event the owner/operator suffers financial reverses, and the owner/operator may not have the credit or cash to secure alternate financial resources.
- *Governmental Enterprise Funds* established to account for financing of self-supporting activities that a governmental unit renders on a user-fee basis. Unlike trust funds, these are not secure from creditors of the local government in bankruptcy. Their permitted investments may be broader than those of a trust fund.
- *Collateral Securities* set aside and pledged to payment of costs.
- *Municipal Pledge of Revenues* from an enterprise activity such as tipping fees from a landfill. (This is allowed in lieu of cash funding for post-closure costs.) The governmental entity may expect that it can better invest its moneys outside of a trust account, and invest money it otherwise might have deposited in a trust account in higher-yielding investments that out-perform the trust account. However, governmental entities' permitted investments are often constrained events outside a trust account, so whether they can secure superior returns is not clear. Governmental entities can model advance (trust) funding versus deferred (pledged revenue) funding options for post-closure costs. Like borrowing to pay future costs, pledge of revenues—or deferral of payment—may result in future rates or tipping fees that are not competitive, because they will have to be artificially raised to pay post-closure costs that are unrelated to present disposal costs. This anti-competitive consequence suggests possible but unclear investment advantages, or a pledge of revenues might not outweigh possible anti-competitive consequences.
- *Corporate Financial Means Test,* such as certain financial ratios (total liabilities to net worth; a ratio of the sum of net income plus depreciation, depletion and amortization of total liabilities; ratio of current assets to current liabilities) and net working capital and tangible net worth multiples of costs; or bond ratings by specified rating agencies such as Moody's or Standard & Poor's. As discussed under Surety Bonds above, it may be more advantageous to invest outside a trust fund.
- *Corporate Guaranty* issued by a parent or sibling corporation of the owner/operator that meets corporate financial means tests. Again, it may be more advantageous to invest outside a trust fund.

The above instruments deal with protection of the environment after closure of a solid waste facility, particularly a landfill that has long-term water and air pollution consequences as the wastes slowly biodegrade. Another set of interesting examples exists for motivating the performance of private contractors or franchisees through performance bonds and sureties. Some insights on both the opportunities and complexities of legally drafting these instruments are illustrated below:

- *Initial Sizing.* Performance bonds are often not sized logically, but comparatively, by looking at requirements in other governmental entities' comparable contracts or codes. However, such loose comparisons could result in over or under-bonding, since it is not apparent from the face of another contract or code text what the gross contract fees are or how long it would take to replace a defaulting contractor. A more logical basis for sizing the performance bond requires at least three steps:

    - Determining the amount of average monthly contract fees.
    - Estimating how long it would take for a new substitute contractor to take over the services of the non-performing contractor, including provisions of the contract for curing breaches, giving notice of breach/default/termination, and terminating the contract.
    - Projecting the costs that the governmental entity would incur to enforce the terms of the contract (or to terminate it) and to re-procure substitute services.

A performance bond arguably should cover the sums of these amounts, *if the contractor collects rates and charges*. However, in some instances, the governmental entity may collect rates and charges. Furthermore, the governmental entity may secure the contractual right to take over the contractor's service assets and provide services if the contractor fails to

do so within a specified time. In that event, the governmental entity might consider downsizing a performance bond to secure premium payment savings to its citizens.

- *Lost Franchise Fees.* Although governments often justify procuring a performance bond to protect the local government against lost franchise fee revenues in event of franchisee default, it is not clear that a performance bond would cover that loss. Franchise fees are conceptually an obligation paid by the franchisee for the privilege of conducting the franchised business. And they are payable from revenues and receipts of the franchisee. They are *not* obligations of the customer. If a franchisee defaults, then there would be no receipts or revenues upon which to pay the franchise fee. Performance bonds only cover contractual obligations. If the franchisee owes no money under the franchise agreement, arguably the performance bond would not cover the loss. Perhaps franchise agreements can provide for compensatory damages in an amount equal to the average of the last specified number of months' franchise fees, in the event of franchisee default. That obligation would then be payable from performance bond proceeds.
- *Re-procurement Costs.* A governmental entity can draw upon a performance bond to get reimbursement of the local government's costs of re-procuring a contract terminated for contractor default and for incremental substitute service costs, only if the contract obligates the contractor to pay those reimbursements. As discussed above with respect to lost franchise fees, these re-procurement reimbursements should probably be structured as compensatory damages consequent upon termination. The contract might add this obligation to better assure reimbursement from performance bond proceeds.
- *Letter of Credit In Lieu of Performance Bond.* In addition to downsizing the performance bond to reflect the governmental entity's ability to apply government-collected rates, the governmental entity might consider switching from a performance bond to a letter of credit for the balance of reimbursement costs, such as lost franchise fees, reprocurement or incremental substitute service costs. Performance bonds best back construction and equipping contracts, not service agreements. Bond sureties prefer to provide substitute contractors and complete performance, rather than pay out money. Many local governments report that liquidating performance bonds is slow and fraught with argument. It generally is more acceptable to local government to have a substitute general contractor complete construction and equipping in accordance with clear and specific plans and specifications than it is for them to have a substitute operations contractor provide service over a term of years. The surety may choose a substitute contractor that does not meet the local government's standards of environmental good citizenship, diversion ethics, lack of litigiousness, or the contractor may be vertically integrated and therefore in direct competition with the local government's own solid waste facilities or service contracts. Contractors often allege that the cost of securing a letter of credit is greater than the cost of securing a comparable amount of performance bond. But by downsizing the bond amount, the cost of the letter of credit may nevertheless be lower, and it is more liquid. It would likely provide more immediate cash, especially if the governmental entity controls the draw. The governmental entity could obtain money, and later argue whether or not the draw was justified by the contractor's default.

CRITERIA FOR CHOOSING AMONG INSTRUMENTS

Given that there are at least 90 possible instruments for the solid waste sector and each of them involves a number of possible activities, the task of choosing the right instrument and approach is not simple. Does one start with improving future waste disposal or with remediating past disposal sites that are contaminating? Is the focus on wastes from households or industries? Do hazardous wastes have priority over non-hazardous wastes? Which are more important—the water pollution or air pollution impacts of solid waste management? Does one start with source reduction of waste generation or with increased recycling after waste generation? If source reduction or recycling are chosen as priorities, which category of waste has priority? Do the lowest cost instruments have priority over the higher cost instruments? Do instruments that address diffuse pollution have priority over those that address point-source pollution, given the potential to address the later through com-

mand-and-control approaches? How much does ease of implementation affect the choice?

PRE-CONDITIONS FOR THE APPLICATION OF ECONOMIC INSTRUMENTS

Functioning markets and related institutions

For economic instruments to add efficiency to solid waste management, a number of interrelated pre-conditions are essential. Foremost is the presence of reasonably well functioning markets with adequately defined property rights, the presence of private enterprise motivated to reduce costs, some degree of competition, competent judicial systems, and limited price distortions. This became apparent as from the first experiences with implementation of economic instruments in the Eastern European countries in transition. Many solid waste systems in Eastern Europe had to be changed after the reform, because the subsidies that supported them were no longer available. In particular, centralized recycling facilities, composting plants, and various incinerators had to be closed; and significant investment in sanitary landfill was undertaken. Efforts to implement economic instruments had to grow apace as the reduction of subsidies developed, state-owned enterprises were privatized, and properties were returned to private ownership (Klarer et al. 1999).

Institutional capacity

Secondly, the effective use of economic instruments requires a certain level of capacity by various different societal institutions. As mentioned, it is necessary to have a well functioning and competent legal system since some of the most powerful instruments for the solid waste sector are legally binding clauses in contracts, such as contract requirements for performance surety bonds, liability insurance, assurance trust funds, letters of credit, collateral securities, take-or-pay revenue pledges. Also, private litigation is one means for even a single individual to cause major environmental change, but this only works if the legal system accepts it and has the necessary capacity to handle the litigation. Many solid waste activities that require a major infusion of capital investment (e.g., transfer, composting, waste-to-energy) can be conducted by the private sector through build-own-operate-transfer concessions. However, such contracts must cover all the needs during the life of the facility, which might mean a 15- to 20-year concession contract. Renewal, refurbishment, replacement issues need to be dealt with for each small and large unit of mobile and stationary equipment, as well as for the civil works, so that the facility still has value and is operable at the time of ownership turnover (Cointreau et al. 2000).

Human and technological capacity is also required for other involved institutions. Economic instruments often require special skills or resources for successful implementation. Disputes by industry are likely and the court costs from suits over discrimination could be costly. Determination of internal and external costs requires objective and complex scientific and economic analysis, so that pricing is as fair as possible. In developing countries, the burden of such analysis may be too expensive and sophisticated for existing institutions to undertake. Once the full costs are known, pricing various charges and taxes to internalize costs may be more than the polluting parties can bear. Also, high pricing may lead to sabotage, corruption, illegal disposal, and various forms of revenue leakage and tax evasion. And yet, where the polluter doesn't pay, the community eventually pays. For example, wherever safe sanitary landfill standards are not required, the community eventually pays through the loss of potable water resources, health problems from degraded air, and stress from excessive noise and odor.

Similarly, to implement user charges based on waste quantity requires the use of uniformly sized and built waste containers that enable monitoring of waste volume at each stop to be an easy task, or requires having a scale on the truck that monitors the weight of each container as it mechanically lifts and empties it. Recovery and recycling of secondary materials (e.g., plastic film, durable plastics, textiles, paper, cardboard, ferrous metals, non-ferrous metals, glass, bone, rubber) requires careful sorting, segregated collection, and development of a strong network of industries to reuse the materials.

Political willingness

A third indispensable factor for successful implementation of economic instruments is political willingness. The political will to implement these instruments is likely to be affected by the impact of these instruments on other economic areas, such as international competitiveness. As was discussed in an earlier chapter, since these instruments are meant to influence investment and consumption behavior, they might also have adverse impacts on trade or

competition among states or countries. Despite the enthusiasm expressed for economic instruments, particularly in Europe, some fear that certain instruments might reduce international competitiveness. There is particular concern that green taxes could cause the more resource and energy intense industries to lose competitiveness and possibly lead some to relocate to countries with a lower eco-tax burden. In European countries, closer scrutiny shows that green taxes are levied mostly on households, transporters, and packaging producers. The majority of the eco-tax revenues come from taxes on motor vehicles and fuels. For reasons of competitiveness, some of the most polluting and energy intensive industries in Europe are given tax exemptions and rebates in return for a negotiated agreement to make some environmental improvement. The OECD is carefully studying this issue of equitable green tax reform and competitiveness for its 30 members (OECD 2001).

THE CHALLENGES

In addition to the range of pre-conditions that have to be fulfilled for successful implementation of economic instruments for solid waste management, three interrelated challenges exist for the sector. The first is that much of the solid waste problem involves what is referred to in the environmental economics literature as "non point sources." It may be possible to closely monitor and regulate or apply economic instruments to wastes generated by large industrial sources or the conduct of large landfill operators. But much of the solid waste that is generated comes form individual households and small enterprises, and much of the collection activity and a reasonable percentage of the disposal likewise involves smaller actors. By their very nature these sources are harder to monitor and therefore harder to regulate with economic instruments or command and control.

This implies, for example, that we cannot expect a textbook system of waste disposal charges to be that effective when illegal disposal or other creative ways around the charges are a real possibility. The limited international experience to date with unit-based charges bears out this caution. (Another practical problem with this system is the sheer complexity of its implementation, and the question of how to combine volume and weight for measuring the charges that are to be assessed.) The lack of unit-based user charges implies an excess production of wastes from an economic efficiency perspective. In practice, as noted below, user charges are often fixed periodic payments, unrelated to the volume, weight or type of wastes involved. In this setting, user charges are a tool for cost recovery and financing of waste services. But even without unit-based pricing, charges that provide for financially sustainable waste management and thereby increase public confidence in the provision of these services will have salutary environmental effects.

The second challenge is that waste management services in most developed and developing countries typically have been offered as public services and treated like public utilities. As experience with other public utilities as shown, there may well be scope for increased private sector participation and competitive provision of services (for example, collection). In other cases (landfill management), there may be stronger economies of scale that argue in favor of limiting the number of participants (public or private). Even where there is a potential for private participation and increased competition, experience with public utility reform in developed and developing countries cautions us that the constraints imposed by past investment experience and existing institutional capabilities must be considered for the potential benefits of more competition to be realized in practice.

The third interrelated challenge is specific to solid waste management in developing countries, including Latin America and the Caribbean. Modest incomes condition the practicability of different policies. Even if very high user charges to reduce waste generation or to deposit wastes in state-of-the-art landfills were technically feasible, the resulting costs could be too high a percentage of income to be politically acceptable. Institutional reforms and industrial organization policies that increase efficiency of waste management and therefore lower costs represent a win-win solution in this context. On the other hand, policies that lead to higher costs because of the removal of public subsidies may be economically and fiscally sound but politically painful.

LESSONS LEARNED ABOUT IMPLEMENTATION

A World Bank study of economic instruments applied in Latin America concluded that although they "can improve environmental management, they normally

impose high administrative demands and do not represent a 'quick fix' to the problems associated with more traditional command-and-control approaches" (Huber et al. 1997). The study further stated that "information building and information sharing were identified as key factors" and that "gradualism and flexibility emerged as fundamental issues in successful implementation" (Huber et al. 1997). Ease of implementation is an important criterion when choosing among economic instruments. Carbon taxes are applied to fuel sales, and are thus relatively easy to calculate and collect. Conceptually, a carbon tax could also be applied to other activities, once a format for calculation has been developed. In theory, if such a tax were to be applied to various solid waste treatment and disposal facilities, it could influence decisions between landfill, composting, and combustion.

The same logic applies to setting the right level of charging or taxation. The recommended principle used in Europe and other high-income countries is that the "instrument should be designed to internalize external costs." In other words, all direct and hidden environmental costs that would be borne by the community in the area of environmental influence should be built into the pricing (EUROPEN 2000). For developing countries, a phased approach of initially setting user charges that achieve full cost recovery of services received by the user (i.e., collection services) may be appropriate to address willingness-and-ability to pay. Over time, the user charges would be increased to also address the cost of services that users feel are public goods (i.e., not directly received by them, such as disposal services). High-income countries, on the other hand, may have user charges that also address externalities (i.e., long-term environmental protection from disposal, and remediation of contaminated resources).

There is no one best way to address the issue of implementing economic instruments for solid waste management. Any solution and policy recommendation would have to take into account the degree to which the pre-requisites are fulfilled and it would have to address the three challenges as described. Based on this any specific policy should be evaluated according to the principles presented in Box 4.

BOX 4

RECOMMENDED EVALUATION PRINCIPLES

- **Environmental effectiveness** – i.e., does the instrument lead to the desired environmental improvements, such as reduction in waste generation, increased waste recycling, reduced emissions from transport and disposal.
- **Economic efficiency** – i.e., does the instrument create incentives for investment and innovation toward reduction of pollution control costs.
- **Administrative cost efficiency** – i.e., does the instrument require affordable and available levels of skill and effort to implement and monitor.
- **Revenue usefulness** – i.e., are revenues generated able to be applied to address the environmental objectives of the instrument and adequate to create measurable improvement.
- **Ease of implementation and replicability** – i.e., are the relative costs and benefits relatively easy to assess and the legal requirements for introducing the new instrument reasonable.
- **Acceptance** – i.e., do the general public and the affected industries accept the instrument as a viable means of cost-effectively achieving environmental improvement without adversely affecting competitiveness, employment, income distribution, and trade.
- **Distributional effects** – i.e., is there distributional disparity or inequity in the application or impact of the instrument, particularly regarding effects on lower income households, small businesses, and disadvantaged parties.
- **Short-term results** – i.e., does the instrument have the potential to result in sufficient short-term improvement to motivate political administrators to undertake commitment to the costs associated with the instrument during their political term.
- **Economic development enhancement** – i.e., does the instrument provide an environment that maintains trade competitiveness and encourages industrial development and employment generation.
- **Waste type applicability** – i.e., does the instrument address a wide range of waste types and have significant impact on overall urban waste quantities, or does the instrument address only a limited number of unique and important waste types.

CONCLUSION AND RECOMMENDATIONS

The traditional approach for solid waste management used in the region has been that local governments, through their own companies or services, are directly in charge of the collection, transportation and final disposal of these wastes. Coupled with this action, numerous rules and regulations of the "control and command" type are applied in order to eliminate or mitigate the externalities associated with the generation and disposal of this refuse.

The option of using various economic instruments has emerged as an alternative to this approach, in order to improve the efficiency and efficacy of waste management. The main economic instrument used in the region has been the involvement of private operators in the collection, transportation and final disposal of wastes. This experience has shown that such a system for industrial organization is feasible, and in general, has been successful as an option for the management of solid wastes, if the central aim is to minimize the costs of providing the services. Its use could be increased throughout the region. Some experience with the deregulation of services to non-residential users is also of high interest.

Although the results from these experiences are favorable, the lessons learned indicate that there are many aspects that must be of special concern in their utilization. These aspects are related mainly to assuring that the service provision is carried out in an effective, competitive framework, with clear and transparent rules, and with adequate policing mechanisms.

Ideally, there should be region-wide coordination of policy on economic instruments. Those instruments that could influence trade, competitiveness, and inter-country transport of wastes and recyclables should be implemented in a harmonized manner throughout the region. On the other hand, to wait for such a comprehensive unified approach could result in many missed opportunities for stimulating change. Environmental progress could be significantly delayed if individual countries wait for a regional policy.

Therefore, building on what already exists should have first priority. If there are economic instruments in place, they need to be reviewed for their effectiveness and improved to the extent possible. The first step in the process should be to have a policy to develop economic instruments and a decision to empower government staff to seek opportunities to implement new economic instruments. It needs to be recognized that each country must learn by doing and that many instruments will be less than perfectly designed. An imperfectly designed instrument does not, in general, create any significant long-term problems. Where the instrument is flawed, it is likely that public reaction, as well as the reaction of industry, will soon let government know that the instrument needs to be amended. And so, imperfection is certainly more tolerable in the process of implementation than no action. It some cases it may be necessary for the national government to provide policy guidelines, so that local officials run less of a political risk when implementing cost recovery measures.

In order to design and implement suitable policies it might be a good idea to create countrywide high-level study commissions for this purpose. The commissions would have to include economists, engineers, lawyers and environmental scientists, as the assessment of options requires a multi-disciplinary approach. The commissions need to be staffed with a group of professionals able to carry out the economic analysis and environmental assessment of each choice. Since each country's economic instruments impact on the national economy and domestic production, this commission should be placed at the highest level of national government, and not under a single ministry. Ministries of environment, land use, natural resources, and finance need to be prominently present on the commission. Once such commissions exist to study and implement economic instruments, they could provide a focal point for external assistance from development agencies, banks, and trade associations.

One type of instrument that has developed in many countries is that of deposit and refund systems for recyclable wastes, especially paper, cardboard, glass, aluminum cans and plastic. In this case, the companies that demand these types of materials have generated a significant market for the recycling of wastes, including their import and export. In those countries where such systems have not been well developed, a more detailed analysis is needed to identify the measures that would allow the stimulation of such markets.

The issue of recycling is related to the social problem of informal collectors. There are experiences in which municipalities have organized these collectors in order to face this matter, trying to "formalize" their activity, thus improving their living conditions. The case study of La Reina in Santiago (Annex 2) shows that it is feasible to develop this type of scheme, although it required a significant subsidy to maintain

its financial feasibility for over eight years. Promoting recycling as a business is another question. As the case study of the recycling of PET bottles in Rio de Janeiro shows (Annex 3), an interesting market for this product exists, and with minimal financial support it can be made financially feasible.

User charges are in principle a key economic instrument to encourage waste minimization and proper waste management throughout the product and waste cycle. In order for this instrument to be most useful it is necessary that charges be directly related to the volume, weight and type of waste, and that these charges be actually collectable. In most cases, however, the necessary conditions for such a charge system are not met. Instead, user charges tend to be periodically fixed values, unrelated to waste generation, and in most cases collection is low. Initiatives to incorporate this charge in other public service bills have helped to increase collection significantly (the cases of many cities in Colombia as well as Guayaquil and La Paz), targeting at least an increase in the financing of this activity. There are charges by weight only in Chile, Colombia and Rio de Janeiro, applicable mainly to non-residential wastes.

In addition to the above, it is necessary to highlight the potentially relevant use of taxes at the final disposal stage, taking into account the residual air, water and soil pollution that is normally caused at this stage. The internalization of this cost along the waste production chain would allow for the correction of an important externality of this activity. There is no experience in the use of this type of taxes in the region, partly due to the financial weakness of the municipalities, which are not in a position for the payment of a tax of this type, either directly or indirectly. Its application should be tied to the strengthening of user charges, as indicated. It would also require stringent control of illegal dumping sites.

Ultimately, the study shows that there are some important economic instruments in use in the region and that their greater dissemination could be of interest for other countries and cities. However, there is still a lack of experience with some instruments that may have a large potential for increasing the efficiency of solid waste management.

The following further suggestions can be given from an economic perspective:

- Economic instruments need to complement rather than conflict with existing regulatory goals and institutions. Instruments that target areas of significant pollution loading and environmental consequences should be given priority.
- Instruments that focus on long-term behavior modification need to be implemented. But new instruments should be introduced in steps.
- Instruments should be in tune with broader economic development objectives in terms of use of labor, energy and capital.
- Consideration should be given to how revenues from economic instruments will be used: for specific waste management investments, general improvement in waste management services, waste-related environmental remediation, or other applications.
- Revenue-providing instruments, such as tax credits, low-interest credit lines, accelerated depreciation and relief from customs duties can provide financial incentives for the private sector to invest in production changes that reduce hazardous substances, increase recyclability, and generate less wastes. Such instruments could also encourage the private sector to invest and participate in solid waste service delivery, including resource recovery. But the use of such instruments needs to be carefully weighed against other considerations, including scarcity of revenue and the possibility that benefits will end up poorly targeted in terms of efficiency. Where they are possible, the application of charges and market strengthening activities have advantages.
- Non-revenue instruments that strengthen liability for damage to the environment or public health could also be useful, assuming the legal system can make such instruments operative.

BIBLIOGRAPHY

Beede, D.N. and D. E. Bloom. 1995. "The Economics of Municipal Solid Waste," *The World Bank Research Observer*, Vol.10, No. 2.

Biomaster. 2000. *Dutch Ministry of Economic Affairs—Policy.* Biomaster, The Netherlands. (http://www.novem.nl/).

British Columbia. 2001. *Overview of Product Stewardship in British Columbia*, Ministry of Water, Air and Land Protection, British Columbia. (http://wlapwww.gov.bc.ca/epd/epdpa/ips/).

Cointreau, S.; P. Gopalan and A. Coad. 2000. *Private Sector Participation in Urban Solid Waste Management—Guidance Pack* (5 volumes), Swiss Technical Cooperation Agency, St. Gallen,

Switzerland. (http://www.melissa.org/cwg/corebibliogaphy.htm).

Commercial Angles. 2001. *German Packing Regulations*. Commercial Angles Newsletter, September 2001.

Correa, M.E. 1998. *Changing Course in Columbia.* United Nations Commission for Sustainable Development.

Duer, H. 1995. *EU and Economic Instruments in Environmental Regulation*, COWI-consult for the Nordic Working Group of Environmental Economics, Copenhagen, Denmark.

Ecotec. 2000. *Study on the Economic and Environmental Implications of the Use of Environmental Taxes and Charges in the European Union and its Member States*, Ecotec, Brussels, Belgium, April 2000, 51 p. (http://www.ECOTEC.com).

Environment Canada. 2001. *Imports of Hazardous Waste Decline in 2000.* Environment Canada, (http://www.ec.gc.ca/Press/2001/010803_n_e.htm).

Environment Daily 2002. *New Tax Slashes Irish Plastic Bag Consumption.* (http://www.environmentdaily.com/articles/index.cfm?action=article&ref=12715).

_____. 2002a. *New Returns System Ends Danish "Can Ban."* (http://www.environmentdaily.com/articles/ndex.cfm?action=article&ref=12735).

Environmental Watch Ireland. *The Black List.* (http://www.home.zonnet.nl/ireland22).

EPA. 1990—USA Environmental Protection Agency. *Charging Households for Waste Collection and Disposal: The Effect of Weight or Volume-Based Pricing on Solid Waste Management*, Publication EPA 530-SW-90-17, EPA, Washington, D.C., September 1990.

_____. 1997 - USA Environmental Protection Agency. *Germany's Green Dot Program.* EPA, Washington, D.C. (http://www.epa.gov/oppt/epp/pubs/envlab/greendot.pdf).

_____. 1999 - USA Environmental Protection Agency. *National Source Reduction Characterization Report for Municipal Solid Wastes in the United States*, EPA Publication 530-R-99-034, November 1999, 80 p. (http://www.epa.gov/epaoswer/non-hw/reduce/r99034.pdf).

EUROPEN 2000 - the European Organization for Packaging and the Environment. *Economic Instruments in Packaging and Packaging Waste Policy*, EUROPEN, October 2000, 21 p.

Fickes, M. 2002 "Banned in Boston (and a few thousand other places)." *Waste Age*, November 2002.

Frith, P. 2002. "A Freeze on White Goods Disposal: Legislation and Implication in the UK," *Waste Management World*, March-April 2002.

Fullerton, D. and T. C. Kinnaman. 1996. "Household Responses to Pricing Garbage by the Bag," *The American Economic Review*, September 1996.

Gale, R.J.P. 1996. "Financial Pinch Leads Municipality to User Fees," Ecological Economics, (http://www.web.net/ecoeco/cs-user.htm).

Green Dot Canada. (http://www.greendot.ca)

Huber, R., Ruitenbeek, J., Seroa da Motta, R. 1997. *Market Based Instruments for Environmental Policymaking in Latin America and the Caribbean: Lessons from Eleven Countries*, World Bank, Washington, D.C., 131 p.

IISD. 1996a - Industrial Institute for Sustainable Development. *Recycling Credits in the UK*, IISD, Winnipeg, Canada. (http://iisd1.iisd.ca/greenbud/credits.htm).

_____. 1996b - Industrial Institute for Sustainable Development. *The User Pay Waste Management Initiative in the Victoria Capital Regional District, B.C.* IISD, Winnipeg, Canada. (http://iisd1.iisd.ca/greenbud/userpay.htm).

_____. 1996c - International Institute for Sustainable Development. *The Landfill Tax in France*, International Institute for Sustainable Development, Winnipeg, Canada. (http://iisd1.iisd.ca/greenbud/landfill.htm).

_____. 2002 - International Institute for Sustainable Development. *Compendium of Instruments.* IISD, Canada. (http://iisd.ca/susprod/browse.asp).

ILSR. 1998 - Institute for Local Self-Reliance. *Waste Reduction Record-Setters—Program Profiles*, Institute for Local Self-Reliance, Washington, DC, U.S., November 1998, 18 p. (http://www.ilsr.org/recycling/wrrs/profiles.html).

_____. 2002 - Institute for Local Self-Reliance. *Innovation, Leadership, Stewardship*. ILSR December 2002, (http://www.stopwaste.org/ilsr.html).

India. 2000 - Government of India Expert Committee. *Manual on Municipal Solid Waste Management.* India, May 2000, 755 p.

Klarer, J.; P. Francis and J. McNicholas. 1999. *Improving Environment and Economy: The Potential of Economic Incentives for Environmental Improvements and Sustainable Development in Countries with Economies in Transition*, the Regional Environmental Center of Central and Eastern Europe, Szentendre, Hungary, July 1999, 83 p.

Lease, K. 2002. *Asian Countries Jump on the EPR Bandwagon,* Institute for Local Self-Reliance. (http://www.ilsr.org/recycling/ftao/ftao41.html).

Macauley, M.K. and M.A. Walls. 1995. *Solid Waste Reduction and Resource Conservation: Assessing the Goals of Government Policy*, Resources For the Future Discussion Paper 95-32.

Multinational Monitor. 1995. Journal. January/February 1995, (http://multinationalmonitor.org/hyper/mm0195.html).

OECD. 2001. *Environmentally Related Taxes in OECD Countries: Issues and Strategies*, Code 972001101E1, Paris, France, 142 p.

PRISM. 2002 - Promoting Renewables: Integration, Statistics & Monitoring. *Analysis of the Legislation Regarding Renewable Energy Sources in the E.U. Member States: Report Concerning Fiscal Measures In Belgium*, PRISM. (http://www.jrc.es/cfapp/eneriure/Reports/BEL%20fin.pdf).

Report of the Study Group on Economic Instruments in Environmental Policies, Japan. 1999.

Rietbergen-McCracken, J. and A. Hussein 2000. *Economic Instruments for Environmental Management – A Worldwide Compendium of Case Studies.* United Nations Environmental Program, Earthscan Publications, Ltd., London, UK, 208 p.

Rolfe, C., Nowland, L., Hillyer, A. 1993. *Economic Instruments And The Environment: Selected Legal Issues*, West Coast Environmental Law Research Foundation and Environment Canada, Vancouver, B.C., Canada. (http://www.wcel.org/wcelpub/4994.html).

Siuru, B. 2002. *Packing a Diesel-like Punch: A Natural Gas Engine that Runs Like It's on Diesel*, *Waste Age*, April 2002.

Speck, S. and P. Ekins. 2000. *Recent Trends in the Application of Economic Instruments in EU Member States Plus Norway and Switzerland and an Overview of Economic Instruments in Central and Eastern Europe—Update of Database of Environmental Taxes and Charges*, Forum for the Future, London, UK, July 2000, 39 p.

Sundt, P. and E. Oland. 2002. "Plastretur: Norway Recycles its Plastic Wastes," *Waste Management World*, March-April 2002.

SVTC 2001 - Silicon Valley Toxics Coalition. *Third Annual Computer Report Card—Computer Take-Back Campaign*, Clean Computer Campaign, Silicon Valley Toxics Coalition, November 2001, (http://www.svtc.org/cleancc/pubs/2001report.htm).

Transparency International. 1999. *TI Newsletter: Corporate News*, Transparency International, Berlin, Germany, June 1999. (http://www.transparency.org/newsletters/99.2/corpnews.html).

UNEP. 2000. "Policy Responses," in *Global Environment Outlook*, Chapter Three, United Nations Environmental Program.

_____. 2002 – United Nations Environmental Program. *Opportunities, Prospects, and Challenges for the Use of Economic Instruments in Environmental Policy Making*, UNEP, International Working Group on Economic Instruments, Second Draft, September 2002.

World Bank. 2002. *The World Development Report 2003*. World Bank, Washington, D.C.

Zwick, S. 2001. "A Better Package Deal?", in *TIME Europe*, May 2001.

Synthesis of Case Studies

SANTIAGO AND LA REINA MUNICIPALITIES, CHILE[6]

INTRODUCTION

The purpose of this document is to present a brief summary of the economic instruments in use for solid waste management in the region and to present two case studies of such use in Chile. These case studies refer to the industrial organization for the collection and disposal of residential solid waste in the city of Santiago and the development of a collection and recycling scheme in the Municipality of La Reina, in Santiago.

This document presents, as a frame of reference based on the available bibliography, the main aspects related to the reality of solid waste management in Latin America. On this basis, we comment on the economic instruments that could theoretically be used to improve the usual problems of low coverage, poor service quality, pollution, etc, currently being observed in the region.

Following that, we comment on the instruments that are being used in the various countries, analyzing their efficacy and efficiency in achieving the intended goals.

The solid waste situation in Chile and its institutional setting are presented in Chapter III, as a frame of reference for the case studies analyzed in this work.

These case studies essentially include the following: a description of specific problems faced and the explicit and implicit objectives used in the design of the instruments; the characteristics of the instruments as such; the main problems and critical factors considered; an appraisal of the results obtained from the instruments' application; and the recommendations and lessons learned.

This study is of a preliminary or exploratory nature, as more detailed quantitative information, which would allow a deeper evaluation and support of the analysis of the various issues, has not been available. This notwithstanding, the available qualitative elements are thought to be clear enough to guide the recommendations that are derived from the analysis.

REGIONAL SOLID WASTE MANAGEMENT SITUATION[7]

In the region, the solid waste sector is generally the responsibility of local governments (municipalities), which have searched various options to improve the service coverage and quality. An important share of municipal budgets (between 20% and 50%) is spent on the administration and management of solid waste services.

In spite of the fact that this activity has high visibility and a high political profile in cities, the public resources destined for the needed investments and their operation have been insufficient. Average coverage for collection in large cities is about 89%, while for smaller cities, coverage fluctuates between 50% and 70%. The municipalities are faced with the additional pressure of constant population and economic growth.

In this setting, many countries have considered, to various degrees, the participation of a private sector initiative to solve the increasing demands of the sector. Currently, private operators under different participation schemes provide about 40% to 50% of

[6] This section was written by Jorge Ducci, Mauricio Arredondo, and Álvaro Fischer..

[7] In this study, "the region" refers to Latin America and the Caribbean countries. Figures cited are taken from Acuirio, Guido, et al. 1997.

the regional services. Even though the benefits of the participation of the private sector in service provision are evident, this requires significant monitoring and policing in addition to an adequate regulatory framework to mitigate the risks to the community, to the local governments and to the private operators themselves.

In general, the services' financing has come from national revenue transfers, from municipal tax revenues and, in a few cases, from rates charged on other public services. User charges have been of limited application and their efficacy has been weak.

Among the most relevant critical aspects for sector development it is necessary to mention the following:

- In general, the norms are dispersed among many legal bodies, with many duplications and contradictions. In this same context, a multiplicity of entities has responsibilities in the sector, a situation that implies coordination problems.
- There is a lack of institutional capacity of the executing and normative entities that must assume sector responsibility.
- There is a lack of information systems that allow the monitoring and comprehensive evaluation of the solid waste services.
- There is a lack of medium and long term planning.
- Private sector participation requires greater transparency in the hiring process and better control of contract obligations, in order to assure an effective level of competition and to exploit economies of scale.
- It is necessary to create public awareness of the real cost of solid waste management and of the importance of waste minimization.

USE OF ECONOMIC INSTRUMENTS

The use of economic instruments for the solution of environmental problems, and in particular for solid waste management, has become more relevant as a tool in order to improve upon the level and delivery conditions of the collection and disposal of wastes.

For purposes of this study, the term economic instrument is understood to refer to any policy, tool or action which has the purpose of affecting economic agents' behavior, with a view to improving the efficiency, efficacy and equity in the allocation of resources, as well as the financing of the activity.

These economic instruments can be contrasted with those "command and control" actions which through norms, regulations, controls and sanctions, try to determine the standards to be followed by the economic agents in their decisions of what, how, when, where and how much to produce and consume.

Among the best known economic instruments applied in environmental issues in general, and in the provision of public services in particular, are user charges and taxes and subsidies that may affect consumption, production, product and production processes' changes, so that the externalities that occur in waste production are "internalized."

In this study, those actions directed to creating or facilitating the operation of markets that through competition may produce price signals for socially efficient decision-making are also included. Among these instruments we find those related to the development of recyclable wastes and to the establishment of rules for private sector participation.

The bibliographical review on the application of economic instruments for solid waste management in the region shows that some of these instruments are being widely and significantly used, while for others only some isolated experiences are known.

Firstly, a frequently used instrument is user charges for the collection, transferal and disposal of solid wastes. At least in countries like Bolivia, Brazil, Chile, Colombia, Ecuador, Jamaica, Mexico and Venezuela there is experience with this instrument (Huber, Richard M., et al., 1998).

For residential wastes, however, it is usual for these charges to be fixed and payable periodically, unrelated to the volume, weight or type of waste being disposed of. In this case, the economic instrument is being directed exclusively to the achievement of cost recovery and not towards the reduction of generated wastes. For example, in the urban municipalities of Greater Santiago, where this instrument has been used for many years and is considered a successful case, recovery is about 55% of service cost.[8] The essential problem is that it is not possible to exclude from service those who do not pay, which makes it impossible to recover the total cost. The use of charges through territorial taxes has the inconve-

[8] See section IV, infra.

nience that collection costs are high, as they usually involve the use of legal mechanisms and, therefore, have a high non-payment rate.

A simple and cheap method for increasing recovery is to add this charge to the bill of some other utility. In Colombia, this unified utility bill is the usual practice in many cities, and it has recently also been used in Guayaquil, Ecuador, and La Paz, Bolivia, where it is applied as a surcharge on the electricity bill (Huber, Richard M., et al., 1998). This policy allows a higher level of recovery, and some degree of progressiveness (higher income families consume more electricity and therefore pay more for solid waste services), even though it generates a distortion in the electricity market, without increasing the efficiency in the solid waste market.

It seems that there are no experiences in Latin America of residential user charges based on volume, weight or type of waste. Even though the necessary technologies exist, the general understanding is that the controls needed for an effective application of this type of charges, and to avoid fraud or abuses, substantially exceed the institutional capacity of local governments.

However, it is possible to highlight the cases of Chile, Colombia and the city of Rio de Janeiro where non-residential user charges are directly related to the weight of the wastes being collected. In Santiago, Chile, for example, these users freely agree on the service conditions with the many existing private collection companies. Under this concept, users internalize at least the private costs of providing the service in their marginal consumption and production decisions, achieving a more efficient social solution.[9]

It is important to note that user charges should ideally distinguish among the costs related to providing the service in each and every one of the stages involved, i.e., collection, transport, transfer, and final disposal. In this manner, a final user might opt, for example, to employ his own means to transport his wastes to a final disposal site, which would charge a fee related to that stage of the service. Differentiated charges by stage exist in countries such as Ecuador, Colombia, Venezuela and Chile (Huber, Richard M., et al., 1998).

A second economic instrument extensively used in the region is the deposit and refund system for recyclable wastes. In countries such as Barbados, Brazil, Bolivia, Chile, Colombia, Ecuador, Jamaica, Mexico and Venezuela these systems exist for products like paper and cardboard, glass bottles, aluminum cans, tires and others (Huber, Richard M., et al., 1998). Under this system a consumer, when buying an affected good, pays an amount that is reimbursed when the consumer returns the recyclable waste.

An interesting characteristic of this activity is that in most countries it is voluntary, based on the interest that many producers have in reusing the recyclable materials. Mexico is the only known exception to this rule, as used car batteries must be returned to acquire a new one (Huber, Richard M., et al., 1998).

An interesting variant of the above refers to the initiatives that some municipalities have taken to organize this process. In many cases in Brazil and Chile,[10] they have organized and "formalized" waste collectors, so that they contribute in a better way to the collection and separation of recyclables, mitigating the social problem associated with these collectors.

Those systems in which the private sector has been involved in the service of collection, transferal and disposal of wastes are included under the definition of economic instruments indicated above. The rationale for the above-mentioned involvement has been the low level of observed coverage, the high inefficiency of municipal operators, the lack of financial resources and the extensive occurrence of illegal dumping.

To date, private operators under direct contract service 40% to 50% of cities in Latin America. Studies indicate that there have been important cost reductions (50% in 5 cities studied) due to larger labor and vehicle productivity. Contract duration is about 5 to 8 years, with periodic re-bidding so that there is competition for the market (Bartone, Carl, 1999).

Lessons learned, among others, in this privatization process are the following: there is the need to develop an overall framework for private sector participation; there have been some justified increases in costs; cost recovery continues to be a problem; municipal labor issues need to be resolved previous to the process; municipal institutions for contract regulation need to be strengthened; and improvement of contract characteristics is needed (well defined standards, payment against results and regular monitoring).

[9] A fully efficient solution would require that private costs be obtained in a competitive environment and that they include all social costs involved .

[10] The Chilean case study presented below examines this experience for the Municipality of La Reina in Santiago.

THE MANAGEMENT OF SOLID WASTES IN CHILE

In general, the situation of the management of solid wastes in Chile involves the problems already noted for the region as a whole. Some specific aspects are detailed in what follows.

The production of solid wastes in Chile has grown in the last decade as a consequence of higher standards of living, higher urbanization and changes in consumption patterns. At the national level, the production of solid wastes has increased 28.6% in only four years, from 0.62 kg/person/day in 1996 to 0.82 kg/person/day in 2000 (INE, 2001). Industrial wastes at the national level reached 2,516,000 tons in 1998, according to estimates by the National Environmental Commission (CONAMA, 2000a), of which 37% are from the Metropolitan region

As the data from the Metropolitan Region indicate, the mix of solid wastes has shown some changes in the 1992-2000 period, with organic wastes having reduced their share from 49% to 42%, and with a growing share of paper, cardboard and plastic, from 29% to 36% in the same period.

Ninety percent of the urban population of Chile has collection services, with a frequency that varies between one and three days per week. The main method for disposing of home wastes is by using plastic bags put out on the sidewalk in a small receptacle. However, in recent years the use of containers for depositing wastes has increased.

In 1981, a process was initiated by which the private sector had an increasing involvement in the waste collection stage, with the result that currently about 90% of the population has this service provided by private companies. This scheme operates through the subcontracting by the municipality of collection, transportation and disposal services. A detailed analysis of this experience for the metropolitan area of Santiago Chile is presented in the following section.

Currently about 85% of the country's urban population has access to final disposal by means of sanitary landfills. In the year 2000 there were a total of 246 sanitary landfills in the country, of which 72 had legal sanitary authorization, and 77 had a useful life of less than 5 years. This notwithstanding, the existence of clandestine disposal sites is still significant (CONAMA, 2000b).

At the national level there is no specific legal framework for the management of solid wastes. Legislation affecting the sector is found dispersed among a great many legal bodies of all types and origins, and with different legal hierarchy. Even though the responsibility for providing the service falls on the municipalities, entities like the Health Ministry, the Housing and Urban Development Ministry and the National Environmental Commission are also responsible for matters related to norms and controls.

CASE STUDY OF THE COLLECTION AND DISPOSAL OF SOLID WASTES IN SANTIAGO, CHILE.

As a case study, this report considers the industrial organization for the provision of residential solid waste collection and disposal services in Santiago, Chile.

Fundamentally, since the early eighties the sector organization has consisted in each of the 56 municipalities that constitute the metropolitan area openly bidding for the collection service with private companies. Up to that date the services were provided directly by the municipalities.

As a consequence of the 1982–1983 economic crisis, and following a tendency of that time towards the privatization of public services, the municipalities adopted a strategy for the externalization of services.

Tender documents have been relatively similar to each other, and they establish the parties' mutual obligations, including aspects such as exclusiveness of the collection area, a 5-year contract duration, standards for the quality of the service (timetables, use of uniforms by employees, new and technically adequate vehicles, etc.), as well as the price to be paid by the municipalities, which generally is a fixed monthly payment.

The essential point of this experience, and one which represents a difference from other cases in Latin America, is that each municipality has acted independently from the others, thereby generating an interesting number of companies that participate in these bids, inducing significant cost savings. Even though only three companies control 60% of the market, current costs are only from US$ 7.7/ton to US$ 26.7/ton.[11] This compares to other, significantly higher prices in the region, which vary between US$ 15/ton and US$ 40/ton (Bartone, Carl, 1999; Acurio Guido, et al. 1997).

[11] According to data gathered by the consultant from different sources.

The rationale for this approach is based on the fact that there are no significant economies of scale at the residential waste collection stage. That is, average costs do not vary with the volume of waste collected. Available data for Santiago, Chile, allow us to corroborate this situation. Under these conditions it does not make sense to integrate the collection service in wider geographical areas. The presence of a high number of service providers (11), and some other 30 potential entrants, assures that there is sufficient competition to maintain minimum possible costs.

Among the problems of the system, that can be improved upon, we highlight the alleged lack of transparency in the awarding of some contracts, the lack of municipal policing which is based mostly on users' complaints, and the existence of numerous clandestine dumping sites.

Referring to transfer and final disposal, the association of the municipalities has been convenient for the purposes of bidding these activities to private companies. To date, there are 3 sanitary landfills, all of which compete, at some level, for the reception of wastes.

In this case, multi-municipal associations or companies have jointly bid for the service, assuring each participant the delivery of wastes from their municipality, in exchange for a payment based on weight received. Contracts are long term (20 years) and they include the obligations set by the concessionaire to receive and adequately dispose of the wastes, complying with the pertinent technical and environmental norms. The concessionaire may also receive wastes from other users, mainly non-residential, freely setting the price to be charged. The rationale behind this scheme is that in the transfer and disposal activities there are significant economies of scale, according to which average costs decrease with the size of the sanitary landfill.

Current prices for disposal in Santiago are about US$ 4/ton to US$ 7/ton,[12] which are below the costs observed in other cities in the region, of about US$4-12/ton. (Acurio, Guido, et al. 1997).

An interesting aspect of this process is that the bidders propose the sites for final disposal, and it is their obligation to buy them and obtain the permits. This permit processing is the most complex and risky aspect of the business, due to the environmental obligations that must be met, which in one case were imposed after the bidding, and the phenomenon of community rejection to having a sanitary landfill in their municipality.

CASE STUDY OF RECYCLING IN LA REINA MUNICIPALITY[13]

The municipality of La Reina, in Santiago, Chile, faced a significant social problem in the early nineties, related to the activity of some 1,500 informal waste collectors (*cartoneros*). At the same time that Municipality, which contains the city's largest park area, had significant clean-up expenditures.

To mitigate these elements, the municipality, together with a company in the waste management sector, took the initiative of organizing a system for the collection, separation and resale of recyclable products, especially paper, cardboard, glass and plastic.

The initiative consisted of organizing the activity by means of granting a permit to a company to install a collection center, providing the collectors (*cartoneros*) with a uniform and a container, and training them in the process of waste separation. The company signed an agreement with each *cartonero* establishing the price to be paid, fixed and adjustable for inflation, by weight and type of waste received.

Originally, the financing of the scheme was based on the resale of wastes that the company would make to manufacturers that demand this type of recyclable products. However, after two years of initial operations, and given the high volatility of the sale price for the recyclables, the permit was reformulated so that the company was authorized to sell space on the containers for advertising, generating additional and more stable revenues. At the same time the municipality exempted the company from payments for the right to use public spaces for advertising.

Under this new financing scheme, the company operated successfully during the following six years. But in 2001, and as a consequence of a significant fall in the price of recyclable products and of advertising sales related to the country's economic downturn, the scheme ceased to be feasible and the company ceased operations.

To date the municipality and the company are negotiating a new type of arrangement to continue this activity.

[12] According to data gathered by the consultant from different sources.

[13] The background information for this case study comes from in-depth interviews with municipal authorities and with the owner of the operating company.

Thirty-three percent of the municipality's families (24,000) participated in the recycling program, with an average of 84 ton/month of marketed products. The greatest recovery rates were for plastic and paper, reaching nearly 40% of the total generated waste. Taking into account that about 40,050 tons are disposed of yearly in the municipality of La Reina, the rate of recycled wastes reached on average about 2% of this total.

In terms of the social objective, the undertaking can be considered a success as it effectively allowed the mitigation of the negative impact of the *cartoneros'* activity, improved the municipal image and its inhabitants' quality of life. From a financial point of view, the net saving was scarce, as only about 2% of the wastes were recycled annually.

Among the aspects to highlight from this experience we find that this initiative was financially feasible for many years, though not from revenues obtained by reselling recycled material; and there was a hidden subsidy in the fact that the municipality did not charge for municipal advertising rights.

The aspects that could be corrected or improved upon are the following: issuing a tender for the permit, avoiding a direct negotiation; a better allocation of price variability risk between the company and the *cartoneros*, eliminating at the same time the risk that the *cartoneros* sell to other competing buyers, and the establishment of a contract between the municipality and the company to define the rights and obligations of the parties.

CONCLUSIONS AND RECOMMENDATIONS

The traditional approach to solid waste management used in the region has been that local governments, through their own companies or services, are directly in charge of the collection, transportation and final disposal of these wastes. Coupled with this action, numerous norms and regulations of "control and command" type are applied in order to eliminate or mitigate the externalities associated with the generation and disposal of these residues.

The option of using economic instruments has emerged as an alternative to this approach, in order to improve the efficiency and efficacy of waste management. In a broad sense, these instruments operate through incentives that affect economic agents' decisions. Included among them are: the policy for setting user charges, all sorts of taxes and subsidies in related markets, and the development of markets for the provision of these services, including the involvement of private operators.

In this setting it is noted that the main economic instrument used in the region is the involvement of private operators for the collection, transport and final disposal of wastes. This experience has shown that such a scheme for industrial organization is feasible, and in general, has been successful, as an option for the management of solid wastes, if the central aim is to minimize the costs of providing the services. Its use could be increased throughout the region.

Although the results from this experience are favorable, the lessons learned indicate that there are many aspects that must be of special concern in their utilization. These aspects are related mainly to assuring that the service provision is carried out in an effective, competitive framework, with clear and transparent rules, and with adequate policing mechanisms.

The particular case of Santiago, Chile, shows that for these purposes the following initiatives has been successful: leaving the provision for collection open to competition and transportation services for non-residential users; issuing tenders for contracts competitively every 5 years at a municipal level without including larger geographical areas; having clear contracts; using users' complaints extensively as support for the policing and control of providers, separating the provision and charges by service stages, and tendering a low number of sanitary disposal sites to exploit economies of scale.

Another type of instrument that has spontaneously developed in many countries is deposit and refund systems for recyclable wastes, especially paper, cardboard, glass, aluminum cans and plastic. In this case, the companies that demand this type of materials have generated a significant market for the recycling of wastes, including their import and export. In those countries where such systems have not been well developed a more detailed analysis is needed to identify the measures that would allow the stimulation of such markets.

The issue of recycling is related to the social problem of informal collectors. There are experiences in which municipalities have organized these collectors to face this matter, trying to "formalize" their activity, and improving their living conditions. The case study of La Reina in Santiago shows that it is feasible to develop this type of system, although it required a significant subsidy to maintain its financial feasibility for over eight years.

For the purposes of achieving efficiency in resource allocation an essential economic instrument

are user charges. For this instrument to be really useful it is necessary for charges to be directly related to the volume, weight and type of waste, and that these charges be actually collectable. Only in this manner would it be possible to have users adjust their waste generation levels to a more adequate level.

The regional experience shows that, in most cases, these conditions are not met. Basically, user charges tend to be periodically fixed values, unrelated to waste generation, and in most cases collection is low. Initiatives to incorporate this charge in other public services' bills have helped to increase collection significantly (the cases of many cities in Colombia and of Guayaquil and La Paz), targeting at least an increase in the financing of this activity. Chile, Colombia and Rio de Janeiro are known cases where there are charges by weight, applicable mainly to non-residential wastes. This is an area where developed countries' experiences may be of great interest.

In addition to the above, it is necessary to highlight the potentially relevant use of taxes at the final disposal stage, taking into account the residual air, water and soil pollution that is normally caused at this stage. The internalization of this cost along the waste production chain would allow for the correction of an important externality of this activity. There is no experience in the use of this type of taxes in the region, partly due to the financial weaknesses of the municipalities, which are not in a position to handle payment of a tax of this type, either directly or indirectly. Its application should be tied to the strengthening of user charges, as indicated. It would also require better control of illegal dumping sites.

Ultimately, the study shows that there are some important economic instruments in use in the region and that their greater dissemination could be of interest for other countries and cities. However, there is still a lack of experience in some instruments that may have a large potential for increasing the efficiency of solid waste management.

REFERENCES

Acurio G., Rossin A., Teixeira P. y Zepeda F. 1997. "Diagnóstico de la situación del manejo de los residuos sólidos municipales en América Latina y el Caribe". Joint publication of IDB/PAHO, Washington, D.C.

Bartone, Carl R. 1999. "Private Sector Participation in Municipal Solid Waste Management: Lessons From LAC". PowerPoint presentation in World Bank Course on Urban and City Management, Toronto.

CONAMA. 2000a. "Antecedentes para la Política Nacional de Residuos".

CONAMA, 2000b. "Catastro de sitios de instalaciones de disposición final".

Huber R., Ruitenbeek J. and Seroa R. 1998. "Market Based Instruments for Environmental Policymaking in Latin America and the Caribbean, Lessons from Eleven Countries." Washington, D.C. Discussion Paper No. 381. World Bank.

INE, 2001: Anuario de estadísticas de medio ambiente 1996–2000, Chile.

RIO DE JANEIRO'S IMPROVEMENT OF ITS URBAN TRASH AND GARBAGE SERVICES, BRAZIL[14]

INTRODUCTION

This work presents a case study of Rio de Janeiro's improvement of its urban trash and garbage services by bringing in private operators to collect the "extraordinary wastes" produced by the city's large generators, without relinquishing its authority to supervise and regulate critical aspects of that service. The costs involved were reduced at the same time. The paper analyzes the operational problems resulting from the adoption of this institutional model and its advantages and disadvantages for both users and public institutions.

The history of the city's trash and garbage collection is traced, together with the progressive changes in pertinent legislation up to the present time. The way waste producers have perceived and responded to municipal measures is analyzed. The economic and financial impact of the collection service on the Municipality and the users shows that a broad sector of private business has been favored, the public municipal trash and garbage enterprise has experienced economic relief, and the cost for large waste generators has been kept at reasonable levels.

[14] This section was written by Luis Edmundo Costa Leite and José Enrique Penido Monteiro.

The paper identifies the positive effects of the new system. The extended service is governed by environmental standards, thus benefiting the environment, while the creation of formal new jobs benefits the most vulnerable unskilled labor segments.

In conclusion, the paper stresses that the dissemination of examples of successful management like this case study can encourage municipal administrations in other Latin American cities to adopt similar initiatives, tailored to their individual social, economic and cultural conditions.

THE TRASH AND GARBAGE COLLECTION SYSTEM: DEVELOPMENT AND RESULTS

Starting in the seventies and up until 1990, COMLURB, the municipal trash and garbage company, was responsible for collecting all solid wastes, except for those amounting to over 120 liters a day produced by establishments that were considered to be "large generators." These establishments had to collect and transport their wastes to the municipal landfill in their own vehicles or hire COMLURB's "special collection" service at a higher cost. This was the system that monitored the final disposal of the solid wastes produced by the large generators and, in practice, it was very inefficient and difficult to operate.

COMLURB had no specific resources for its special trash and garbage collection service. It used its regular household waste collection labor, vehicles and equipment. The large waste generators, despite paying extra for their service, always came last. The supermarkets and shopping centers, which generated large amounts of waste and had nowhere to store it on their premises, were those most hurt by the system.

With the passing of Municipal Decree 9287 in 1990, in response to protests over the special services and the excessively high rates charged for them, COMLURB ceased to be Rio de Janeiro's exclusive trash and garbage collector. Some unqualified private companies, in the unregulated urban trash and garbage collection sector, started to serve large supermarket and major hotel chains and other large waste generators requiring companies with an ample service capacity. COMLURB continued to provide fewer extraordinary collection services until 1993, when they were finally cancelled by a legal resolution that set the maximum volume of normal waste production at 100 liters or 50 kilograms a day. Private trash and garbage collectors would serve the market segment producing more than that volume, with COMLURB maintaining only a regulatory function.

The private special collection service was not immediately effective; nor were the establishments served by COMLURB immediately transferred to private trash and garbage collection companies. Large corporations, in particular, questioned the legality of resolution 03/93 in the courts and opposed the new provision because of the shortage of private services. In 1994, several companies purchased vehicles and hired sales personnel to sell their collection services to the large waste generators. Some of the latter, particularly bars, restaurants and small markets, decided at first to hire persons and vehicles that were not registered with COMLURB. As a result, their wastes were both collected and disposed of very irregularly in the city. Even so, by 1994 the city had five companies that were qualified, under the new provisions, to provide trash and garbage collection services to large waste generators. They collected a total of 13,293.25 tons/month overall, which was equivalent to 7.2% of the total trash and garbage collection in Rio de Janeiro.

COMLURB had a large job between 1994 and 1998, supervising the private companies. While violators were frequently fined, the fines were systematically and successfully appealed because the authority had only one Municipal Decree as its legal backing. In 1998, Municipal Act 2630 set new limits for classifying small and large waste generators (120 liters or 60 Kg a day). The Technical Regulations (42-30-01) for that Law, published the same year, established the standards and procedures for large waste generators and the companies collecting and transporting those wastes. Under the new legislation, in 1998, 11% more extraordinary wastes were collected than in 1997; the total was 292,100 tons or 10.5% of all of the trash and garbage collected in the city of Rio de Janeiro. In short, between 1994 and 1998, the collection of waste from large generators rose 45.8%.

In 2001, Municipal Act 3273 approved the Urban Trash and Garbage Collection Regulations for the City of Rio de Janeiro. COMLURB's authority under Decree 9287 was increased, making its supervisory and proactive efforts to broaden service coverage more likely to succeed.[15]

[15] Other laws and regulations that are pertinent to this case are: (1) the Urban Trash and Garbage Regulations for the City of Rio de Janeiro (Regulations for Municipal Law 3273, April 19, 2002) stating that the generators are responsible for managing theirs special wastes, including extraordinary wastes, and that they must comply with the relevant technical provisions and operational procedures; and (2) Technical Provi-

By the end of 2001, twelve companies were authorized to collect the extraordinary trash and garbage. They handled a total of 355,890 tons, equivalent to 12% of the total trash and garbage collected in Rio de Janeiro. In 2002, 12 companies (a fleet of 250 waste collection units) were serving 6,122 establishments, with an average monthly collection, over the first nine months of 2002, of 31,146 tons. The companies that offer this service have invested not only in traditional vehicles, but also in special and alternative ones. They have installed stationary compactor boxes for large waste generators like supermarkets, to increase their productivity and reduce their customers' operating costs. Smaller trucks have been purchased to serve small customers like restaurants, banks and offices in the city center with its narrow streets.

ECONOMIC AND FINANCIAL ASPECTS

Service to large waste generators is based on a price and rate scale set by the private companies, in accordance with the type, number and capacity of the trash and garbage bags and containers that are collected. The prices vary widely because this market is highly competitive and dynamic. Customer surveys show that the oldest clients tend to pay higher prices than those with more recent contracts with the same company. The companies charge a fixed rate set by contract for a minimum waste collection. Any surplus is paid for at a higher preset rate.

Trash and garbage collection prices for large waste generators has declined steadily, from an average of R$ 0.30/kg in 1994 to an average of R$ 0.13/kg in 2003. Unit collection prices vary according to container type and capacity, as follows:

- For 100-liter plastic bags, the prices vary up to 33%, from R$ 0.90 or US$ 0.26, to R$ 1.20 or US$ 0.35 per bag removed.[16]
- For 240-liter plastic containers, the prices vary up to 71%, with a minimum of R$ 2.45 or US$ 0.70, and a maximum of R$ 6.20 or US$ 1.77 per container removed.
- For 1,200-liter metal containers, the price is R$ 25.00 or US$ 7.00 per container removed.
- For waste in stationary compactor boxes with a 15 m^3 capacity, the price is R$ 500.00 or US$ 142.85 per box removed.

Private trash and garbage companies earn large profits, even after paying COMLURB for use of its transfer station, transportation service and final disposal of the wastes (this represents only 8.7 % of the companies' revenues). Ten of the twelve companies that provide trash and garbage collection services to large waste generators have operated in the market without interruption. This service has lightened COMLURB's burden and has proven to be extremely profitable. The rates today are much lower (nearly one tenth of what COMLURB would be charging now, under the previous system), and cover a much larger percentage of waste generators that the municipal trash and garbage collection company would had to continue serving otherwise.

The users' willingness to pay has never been a problem because the amount involved is very small in comparison with their earnings. Since the service is good, few are overdue in their payments.[17] A study of restaurants, for example, found that they pay only about 0.5% of their monthly revenues for extraordinary trash and garbage collection—equivalent to one-tenth of their electric bill.

Environmental and social aspects

Private extraordinary waste collection has produced considerable environmental and social benefits. The most important environmental effects include the following:

- Vehicles authorized under technical provisions to provide this service must respect emission limits for atmospheric and acoustic contamination and comply strictly with pertinent legislation. When COMLURB was responsible for operations, and even less so when unauthorized vehicles participated in the service, emission control was not enforced. Authorized vehicles must be kept clean, deodorized and painted at all times and the waste must always be stored in standard containers, avoiding their spillage in the streets.

sions 42-30-01 (provided for in that same Law 3273) stipulating the procedures for authorized companies to register extraordinary waste collection vehicles and equipment and to collect and transport the wastes.

[16] Considering an average exchange rate of R$ 3.50 (three *reais* and fifty *centavos*) per dollar.

[17] Payment of the charge directly to the service provider, rather than jointly with other municipal charges (i.e. housing taxes), as was the case when COMLURB offered the service, has a positive effect on the waste generator's perception of the service, and therefore on its willingness to pay for it.

- Today, all extraordinary wastes end up in sanitary landfills, which was not the case in the past. All collection and transportation operations must comply with the technical provisions; otherwise, the offending company will be fined and may even lose its operating license.
- Extraordinary waste collection has boosted the recycling of appropriate materials. Some authorized trash and garbage collection companies have set up differentiated collection services (i.e. cardboard at shopping centers), thus facilitating recycling.

The change in management for the collection, transportation and final disposal of extraordinary solid wastes has opened up approximately 600 direct jobs—as drivers, collectors, maintenance mechanics and sales and administrative service professionals—without COMLURB having had to dismiss any of its workers as a result of the new system. Furthermore, the wages and social benefits paid represent significant earnings for these newly employed unskilled workers.

LESSONS LEARNED

COMLURB's opening of the extraordinary waste collection market has had positive results: service costs have been reduced and a priority sector for municipal services has been encouraged; new direct jobs have been created; COMLURB has been freed from having to collect and transport extraordinary wastes; and the environment has benefited from the reduction in irregular waste disposal and the growth of concern among their generators over the quantity and type of solid wastes produced.

At first, to get more waste generators to join the system, the establishments and the unregistered companies providing the trash and garbage collection services had to be closely supervised. Fines were imposed and gradually reduced as the waste generators demonstrated their compliance with the system. Initiatives of this kind require, especially at the beginning, an efficient supervisory system to monitor the large waste generators and the unregistered trash and garbage collectors, with supervision of the sanitary landfills to identify the origin of the wastes transported by each collection vehicle.

The final recommendations to be made include the following:

- The private sector should participate in accordance with free market conditions. Prices should be freely arranged between the contracting and contracted parties without municipal involvement, but always under government supervision and regulations.
- Private sector participation in the collection of extraordinary wastes is highly positive for medium-sized and large municipalities, for it frees the municipal trash and garbage collection service from that job.
- Municipalities should prepare regulations that effectively impede trash and garbage collection companies from dirtying the public streets by prohibiting waste collection except at scheduled times of day or the use of trash and garbage collection vehicles that are not suitable for the types of waste to be collected.
- Differentiated services are needed for specific customer needs: the use of special or alternative equipment, the provision of services on specified days or at scheduled times, and the supply of special containers that are appropriate for the wastes involved.
- The operation of trash and garbage collection systems under conditions of open competition benefits customers by allowing them to choose, from among several companies, the one that offers the most advantageous conditions and the best prices.
- Waste collection from large generators, as it was developed in Rio de Janeiro, is an effective mechanism for obtaining economic, environmental and social gains, to be shared among municipal authorities, the service providers, the waste generators and the general population.

SUSTAINABLE RECYCLING OF PET BOTTLES IN RIO DE JANEIRO, BRAZIL[18]

This work presents a case study on solid waste management in the city of Rio de Janeiro. This privately-owned initiative involves the application of

[18] This section was written by Luis Edmundo Costa Leite and José Enrique Penido Monteiro.

market instruments to boost the recycling of used plastic bottles. This, in turn, has promoted the growth of a new economic activity, creating a significant number of new jobs.

More specifically, this case study demonstrates the technical and economic viability of recycling used PET (Polyethylene Terephthalate) bottles taken from city trash collection. The project is a private venture, and the only indirect subsidy provided by the government was the public land donated by the municipality for the construction of the industrial recycling plant.

PET RECYCLING PROCESS AND MARKETS

The study describes the "PET bottles" product and explains its characteristics and properties, the manufacturing technology adopted in recent years, the different uses made of the recycled material for making blankets, ropes and fiber fabrics, as well as utensils and products such as bottles, containers and packaging. PET soft drink bottles are the plastic containers most frequently manufactured and recycled today. At present, an average of 30% of all PET soft drink bottles are recycled. In North and South America, a total of 430,000 tons of PET bottles were collected in 1998, and in 2003 this figure will probably reach 740,000 tons. Although bottle collecting is growing in importance in other countries, the United States is, and will continue to be, the region's largest individual source of post-consumption bottles.

Brazil produced 360,000 tons of PET bottles in 2001 and the annual growth of that sector is estimated to be on the order of 10%. The consumption and recycling of PET bottles has grown heavily in Brazil. Consumption, which stood at 1.8 billion bottles in 1994, rose to 5.7 billion in 2000, while recycling increased from 290 million bottles in 1994 to 1.5 billion in 2000.

In 2001, the industrial markets for PET bottles were soft drinks (80%), mineral water (10%), edible oil (6%) and others (4%). Today, PET bottle manufacturers are interested in tapping the beer market with its sales of nearly 9 billion liters a year. Despite this big market, the industry is unable to guarantee PET bottles with a minimum durability of 180 days, required for other materials used in the industry, mainly glass and aluminum.

The analysis emphasizes the large potential for growth of the PET bottle industry and how its development is "friendly" to the environment and beneficial to the economy. Recycling this type of plastic bottle makes it possible to reuse the raw material to manufacture the same product—in other words "bottle to bottle recycling"—that will be of the same quality as the original bottles made from new material.

The data that has been collected about the PET recycling market by separating the trash into its components, or through selective collection programs, reveal that the prices of the used PET bottles (unpressed and of different colors), which in 2000 amounted to 0.20–0.25 R$/kg, by 2003 have risen to 0.35–0.40 R$/kg.

THE RECOVERY PLANT IN RIO DE JANEIRO

The PET recycling plant was built in 1994 on a 1,000 m^2 plot on the grounds of the COMLURB (Rio de Janeiro Municipal Urban Trash and Garbage Company) Recycling and Compost Plant in the Jacarepaguá sector of Vargem Grande district in western Rio de Janeiro. A classifiers' cooperative was set up and operates with COMLURB infrastructure, presses, bottle storage spaces, etc. The classifiers' location side by side with the PET Recycling Plant minimizes the cost of transporting the used bottles to the plant. The subsidy in the form of COMLURB's assistance to the cooperative for its operation has a cash value that is equivalent to the cost that the Trash and Garbage Company saves from not having to collect, transport and dispose of the bottles the classifiers separate and handle. Otherwise, these costs would be incorporated into household trash and garbage charges. The collectors' classification of the trash avoids what is known as undisciplined separation, in which street classifiers, who tear open the plastic household trash and garbage bags and remove articles that can be recycled, leave the remaining trash and garbage, organic and other wastes scattered in the streets, creating more work for the city trash and garbage service.

PET recycling is basically a three-stage process: first, the PET bottles are converted into PET flakes (by selecting, grinding and washing them); second, the PET flakes are used to produce PET (by rolling, crystallizing and melting them); and third, the final PET products are manufactured (by molding the products from PET film).

The economic analysis of the PET plant reveals that all three integrated stages of the industrial pro-

cess (the production of flakes, rolled sheets and packaging from the laminates) yield a highly profitable gross return of 6%.

The study shows that the future of the market for used PET bottles in Rio de Janeiro will depend on whether more classifiers' cooperatives are established and whether the people cooperate by separating their used PET bottles at home. There are several important conditions to be met in regard to government regulation, tax aspects and the marketing of the products that are manufactured from recycled PET. In the area of government regulation, there are three basic mechanisms for increasing the collection of PET bottles (of which the case under study has adopted the first two): (a) the enforcement of legislation compelling the population to separate the materials that can be recycled in their own homes: (b) the organization of collectors into workers' cooperatives; and (c) the passing of laws that will require PET bottle manufacturers to take part in recycling projects by providing operational and financial assistance.

The paper analyzes the tax and fiscal aspects and shows that fiscal incentives are critically important for guaranteeing the economic viability of recycling plants by encouraging more collectors to supply used bottles to the recycling industries and by making recycled materials more competitive with new raw materials.

From a marketing standpoint, it is important to carry out advertising campaigns that associate the products manufactured from recycled PET with environmental conservation. The people will then view all of the recycling initiatives, from the collection of the bottles to the marketing of the finished products, as favorable activities. A concrete example is a successful cooperative that has been operating for some time on the outskirts of Rio de Janeiro. It uses recycled PET bottles to manufacture the material for T-shirts that bear an emblem that is associated with environmental conservation.

The conclusions we can reach or the lessons we can learn from the case study of the Jacarepaguá recycling plant include:

a) From the general viewpoint of the recycling system:

- A self-sustaining recycling system depends on two basic elements: (a) a regular and sufficient supply of raw material, and (b) an industrial infrastructure that will use the raw materials to manufacture finished products for reentry into the market.
- The only sustainable system for collecting recycling materials that does not require government subsidies is the system of classifiers, organized into cooperatives. In an orderly way and following a preset schedule, these classifiers gather in the streets the materials that people have already separated at the source—in their homes.
- The success of the recyclers' cooperatives will depend on whether the government will support the effort by carrying out continuing programs to heighten people's awareness of the recycling effort, so that they all participate.
- Industrialization of urban waste recycling can be economically viable if government support is obtained (not necessarily in the form of direct financial subsidies) for the implementation of measures to reduce the transportation and processing costs of materials that can be recycled.
- The government should be responsible for carrying out and keeping up a consciousness-raising program that will lead people to separate materials that can be recycled. This will increase the supply of used bottles.

b) From the viewpoint of the recycling market:

- It is necessary for the raw material produced by waste recycling to have an added value that will justify its use for manufacturing and cover its transportation costs, which are high in comparison with the cost of moving new raw material.
- There will be no market for materials that can be recycled and no one will pay reasonable prices for them, unless industries can use them, thereby generating a demand and, consequently, better prices for the classifiers. It is essential for the government to boost the development of simple technologies that require only small investments and have reduced operating costs, in order to give the material for recycling an added value.

c) From the more specific viewpoint of the Jacarepaguá PET recycling plant:

- A large (and growing) amount of the urban trash in most Latin American cities consists of used PET bottles. A significant percentage of those bottles, even when good trash

collection systems operate, today end up in rivers, oceans, canals and wasteland, creating health problems among urban residents, widespread environmental damage, and substantial visual pollution.

- The case study shows that the technology for recycling those bottles and turning them into raw material for the manufacture of other products is simple and safe. The process is also economically sustainable, so long as the government creates appropriate conditions. COMLURB's donation of an unused plot of land and an unoccupied shed helped make the project viable.
- Long-term PET bottle recycling removes these materials from the trash and the environment, lessens soil contamination problems, and contributes to the creation of new jobs and the entry into the workforce of people with few or no professional skills.
- The operation of the Jacarepaguá plant has shown that economically sustainable recycling initiatives are possible, as long as the government encourages business, the people directly involved in the recycling, and the population at large to work together.

MONTEBELLO MUNICIPALITY, COLOMBIA[19]

INTRODUCTION

This document presents the urban experience of Montebello, a small municipality in Colombia's mountainous northwest region, with 10,400 inhabitants, of whom 1,850 are urban dwellers, and in which a variety of economic instruments were implemented to underpin the sustainability of a solid waste management project.

CONTEXT

Montebello is located in the department of Antioquia, Colombia, 51 km from Medellín. It covers 83 km^2 of rugged topography. The town is situated at an altitude of 2,350 meters, has an average temperature of 16°C and receives 2,600 mm of rain a year.

The urban area is well endowed with infrastructure. The water supply, sewerage and garbage removal systems are administered by the Municipal Office of Public Services. The water system supplies 100% of the urban population with water, with a very low sanitary risk, in adequate amounts and with sufficient continuity and pressure through a system of household connections. The sewerage service serves 95% of the community and discharges the wastewater directly into the La Miel River without any treatment whatsoever.

The electric power and telephone services are supplied by departmental enterprises. They are good quality services with 100% coverage of electric power and 18 telephone receivers per 100 inhabitants. Cellular telephony is widely used.

A monthly service charge is paid for each of these services (excluding telephone service), averaging around $25,000/month (US$ 9.10/month) per household.

The local economy is agriculture-driven: coffee (3,200 hectares and 1,600 tons/year), bananas (510 hectares and 2,040 tons/year) and avocados (60 hectares and 180 tons/year). The second activity is small-scale feldspar mining. A rural cement factory contributes almost 90% of the industrial and trade taxes collected by the municipality. The municipal administration is the major employer in the service sector.

Montebello's budgeted income for 2002 was $2,732 million (US$1 million), 24% consisting of its own revenues and 76% from the municipality's share of current national income or transfers. Some 28% of this budget is earmarked to cover operating costs and 72% for investment. A noteworthy fact about the municipal finances is that Montebello has no public debt.

BACKGROUND INFORMATION ON THE PROJECT

Before 1989, a municipal dump truck collected the garbage once a week and dumped it along the border of the urban area; the service was free of charge, but the poor state of the roads kept the coverage from

[19] This section was written by Héctor Collazos and Ramón Duque.

reaching 100%. Street cleaning, generally on weekends, was limited to the central park and the main streets.

In 1989–1990 a manual sanitary landfill was designed on land belonging to El Olival, a district of Montebello, and it entered into operation in 1992. By 1995, municipal government decisions had turned it into an open dump. It was at that point that the community living in El Olival protested and blocked the site.

Some of the inhabitants of El Olival began to recycle the paper and cardboard in an effort to reduce the environmental impacts and earn a little extra income. They ran up against many problems because "the trash reaching the dump was very dirty." The community proposed the possibility of recycling and putting the organic wastes to use. This is how the present project was born.

PROJECT DESIGN

The project design did not follow the traditional linear process. It was first formulated in mid-1996. The participants included different departments of the municipal administration and El Olival community, which received both financial support and technical assistance from the Committee of Coffee Growers and from the Montebello municipality.

The project was launched in 1998 with the production of worm-generated compost and recycling resting on local experiences. The incineration of the remaining waste was added due to the opposition of the inhabitants of El Olival to the existence of the landfill. CORANTIOQUIA is financing the infrastructure. The Montebello Women's Association (ASOMUBELLO) became involved in the recycling component and the local police and the educational sector, through the secondary urban schools, were brought into the community promotional campaigns for separating the solid wastes. Composting was a later addition. The National Traineeship Service (SENA) joined the project in June 2002 as adviser to optimize the management of organic wastes.

The guiding criteria and use of economic tools were defined during this dynamic design process: the decision to turn a problem (that of the final disposal of solid wastes) into an opportunity; the involvement in the project of the community, community leaders, community civic organizations, local and regional government agencies and private agricultural organizations; the boost given to recycling and the turning over of the job to an organized group of female family heads, ASOMUBELLO; the utilization of organic wastes at the site where the badly operated sanitary landfill had operated, and the choice of the El Olival community to do this work; the decision to buy, through the Municipal Technical Agricultural Assistance Unit (UMATA), all of the production of the compost and the worm-breeding operations for its farmer support programs.

The main problems revolved around being able to convince some external institutions of the merits of the project and to correct local shortcomings in project preparation and timely decision-making, caused by a lack of experience in the comprehensive management of wastes.

PROJECT DEVELOPMENT

The comprehensive management of the solid wastes project is made up of the components shown in the diagram and following tables. Its development rests on management, administrative and promotional activities coordinated by the Municipal Planning Office, which bring together different municipal departments (Office of Public Services, UMATA, Cultural Center, Local Hospital, Secretariat of Education, Local Police), the community (whether organized or not) and

DIAGRAM

RELATIONSHIP AMONG THE DIFFERENT ACTIVITIES OF THE PROJECT IN MONTEBELLO

regional institutions (SENA, CORANTIOQUIA, and the Coffee Growers' Federation).

These institutions meet in committees organized by work topics and in a Coordinating Committee that continuously plans and evaluates the project, and makes the key decisions regarding it.

EVALUATION OF THE PROJECT'S SUSTAINABILITY

The project's sustainability, understood as its capacity to continuously provide the benefits expected of it, with a minimum use of resources and the conser-

COMPONENTS OF THE MONTEBELLO, COLOMBIA, PROJECT

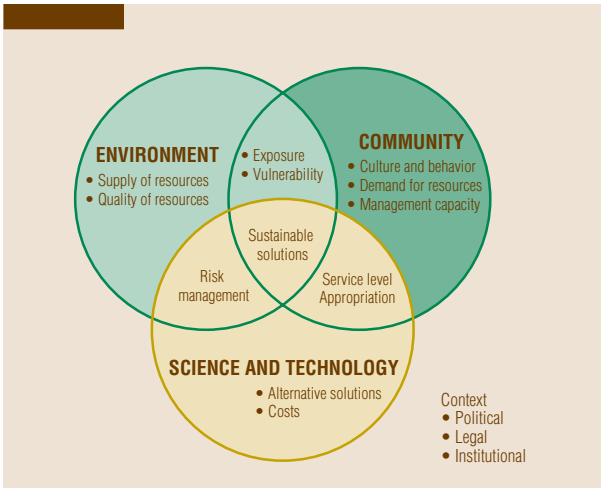
Production:	24,000 kg/month 0.40 kg/person-day.
Household separation of solid wastes:	Carried out by the community, 90% of the users. 1 container for rapidly biodegradable garbage and trash. 1 plastic bag for the toilet. 1 container for recyclable material. Unit cost (US$ 1.89/ton) The costs include both the operation and maintenance and recovery of the investment. Costs are assumed per user.
Collection:	A truck collects biodegradable and toilet wastes at the same time, while a second truck collects what can be recovered. 100% coverage. 2 times a week. Total unit collection cost US$ 31/ton.
Recycling:	Paper, cardboard, glass, metal and plastic are recovered. Recovered 3,600 kg/month. Unit cost US$ 39.75/ton. Marketing revenues US$ 24.75/ton. The Association of female family heads, ASOMUBELLO, a local community organization, takes care of the recycling.
Utilization:	Compost and humus (worm breeding) and protein (worms) are produced from the rapidly biodegradable organic matter. Utilized 12,000 kg/month. Final product 4,600 kg/month. Unit cost US$ 32.58/processed ton. Marketing revenues US$ 81.69/product ton. The inhabitants of El Olival district, organized as a community, are responsible for the utilization. Institutions provide advisory assistance.
Incineration:	Toilet matter and the matter rejected in the recycling and utilization processes are burned in a device using ACPM. Incinerated 8,400 kg/month. Unit cost US$ 35.14/ton. The El Olival community is in charge of the operation.
Final disposal:	Sanitary landfill. Approximately 240 kg/month of ashes and inert matter are finally handled. The costs are included under utilization. Operated by the organized community of El Olival.

vation of the environment, should be built on the simultaneous junction of three major dimensions immersed, in turn, in the political, legal and institutional contexts: the community, consisting of its inhabitants, culture and institutions and which, in the final instance, is the actor that establishes the conditions for its demands for environmental goods and services; the environment, in which the community lives, produces and manages its development and which offers its resources for rational use; and the knowledge base, represented by science and technology geared towards the solution of problems related to vulnerability and exposure to risk (defined by the relationship between community and environment), as well as towards the supply of, and demand for, resources by means of services.

These three dimensions and their inter-relationships evolve within a political, legal and institutional context that defines their boundaries. Within these dimensions one identifies the economic, financial, legal, and institutional regulatory framework, the quality control rules for environmental services, and the technical cooperation required.

The project as a whole was started five years ago and its evaluation gives reason to believe it will last much longer. Some of the grounds—or lessons learned—upon which project sustainability are based include:

- The community is familiar with the project and performs specific activities, like separating the solid wastes at the source (90% of the users) and participating in the educational campaigns, particularly the children and young people.



Source: Cinara, Universidad del Valle, Cali, Colombia

- The community pays promptly for the service (90% of the users).
- Local institutions join forces with regional and national institutions.
- Thus far, the local government and its institutions are responsible for the momentum of the project, insofar as its administrative handling and overall management are concerned.
- A 68% reduction in contamination has been attained as a result of the solid wastes that are re-utilized.
- According to the analyses made by the environmental authority, the project does not produce any atmospheric contamination.
- Environmental awareness among the citizens has increased, as expressed in their support for the new project.
- All of the technical equipment can be operated, maintained and administered by the community, except for the incineration.
- The existing legal system is conducive to organized community participation in the provision of the services, an endeavor that has proved useful in small communities.
- The regional and national institutions are geared toward providing financial support for the investment and technical cooperation for the project.

THE FINANCIAL SUSTAINABILITY OF THE PROJECT

The financial sustainability of the project has rested in large part on the use of economic instruments that have contributed to the attainment of large coverage, good service quality, promotion of recycling, and effective environmental management and conservation. It is important to bear in mind the intensive community participation in the Montebello project, accompanied by efforts coordinated with local government institutions, with continuous and mass educational campaigns and the cooperation and work of regional and national institutions. The financial results and economic instruments used include:

- *Costs and financing sources.* The total investment cost was $160,200,000 (US$58,250) and its recovery is included in the project's cost calculations. The financing sources are: private institutions (the National Federation of Coffee Growers,

28%); regional institutions (CORANTIOQUIA Regional Environmental Corporation, 22%); and the Montebello Municipality (50%). The annual operating cost of US$19,367 is covered as follows: US$2,494 a year (13% of the total cost) from a direct municipal subsidy; US$4,873 (25%) from marketing revenues; and US$12,000 (62%) from community service charges and other payments. The direct municipal subsidy is needed to cover the cost of the services for the lowest-income groups (1 and 2), inasmuch as the crossed subsidies from service payments by residential users (group 3) and commercial users are not sufficient. The social benefits produced by the project fully justify this direct subsidy. These benefits include the strengthening of the community's self-management capacity; the reinforcement of the social fabric, and social capital formation; and the creation of local jobs and a positive setting where fellow citizens live in harmony with their environment.

- *Service charges.* The municipality has established a differentiated rating scale for the 570 residential, commercial and institutional users. Users in the first two categories have been broken down into three income groups according to their economic capacity, as estimated by the physical conditions of their dwellings or commercial establishments. The monthly residential rate ranges from US$0.20 for the lowest income group, US$0.76 for the intermediate group, and US$1.49 for the highest income group. Commercial and institutional users (110 users) pay rates of US$ 1.53 to US$2.73 a month. Crossed subsidies are obtained for the lowest income residential groups.
- *Joint collection of service charges.* Charges for municipal garbage, water and sewerage services are collected jointly. Any delinquency in payment is handled through friendly arrangements. If the latter fail, the water service is cut off until the user pays the amount owed. The good quality of the services and the active involvement of the community in the project have contributed to a timely payment rate of 90%, with maximum delinquency standing at 3 months.
- *Revenues from marketing of processed materials.* The project generates sales revenues from the marketing of recycled materials and of processed products (compost, humus and protein). Incineration services to third parties, together with consultations, visits and sales of educational materials produce other minor earnings. These revenues amount to US$4,873 a year, or 25% of the total income.
- *Transparent accounting practices.* The municipality keeps separate project accounts that are open to all participants, including the community. When the resources are shared with other projects, costs are assigned on a time use basis. Values are calculated on the basis of the costs incurred, without including returns on the invested capital, but considering its recovery.
- *Technical support for the operation*. Different institutions, state-related or not, provide technical assistance to help the municipality and the community solve their problems more efficiently. CORANTIOQUIA offers support for environmental evaluation and the incineration operation. The Federation of Coffee Growers and the National Apprenticeship Service use and market the materials that are produced. The cost of the technical assistance is charged to those institutions.
- *Incentives for community participation.* An organized group of women household heads from Montebello is in charge of waste recycling. As an incentive, the association (ASOMUBELLO) is given all of the earnings from the marketing of the recycled products, which are distributed among the members who participated in the work. The organized community from the El Olival district receives a cash payment for 74 days of work in activities such as composting, humus production, incineration, and management of the sanitary landfill, where ashes and inert materials are disposed of.

Recommendations for the Project's Replication

This final section presents some key recommendations for effective solid waste management in Latin America and the Caribbean, taking into consideration that each country and city will demand a different set of actions and methodological approaches:

- Encourage community participation throughout the project cycle (problem identification, planning, design, execution, operation, maintenance and evaluation). Community participation should be incorporated in the provision of services, project administration and management of the different activities throughout the project cycle.
- Approach solid waste management issues comprehensively and from an early stage; establish the necessary linkages between waste manage-

ment and other community development issues, as well as broad national and regional concerns.

- Study alternative solutions, taking into account the local, political and institutional sustainability of projects. The leading concerns are: the community, with its cultural, social and economic development aspects; the environment, with its natural potential, requirements and limitations to provide long-term sustainability; and technology, which is linked to the former two dimensions and which management solutions depend upon.
- Solid waste management can open new development opportunities if accompanied by economic solutions. Economic approaches and instruments can be brought to bear before wastes are produced, and at the time of waste collection, transportation, treatment and disposal.
- Promote participatory education as an essential component of solid waste management (by combining knowledge, one can produce effective solutions)

Projects like this should be promoted by national governments, especially in smaller cities where the private sector is not sufficiently attracted to become involved in solid waste management projects. This can be done by incorporating such projects in national legislation and regulations, thus supporting their introduction and development in local communities; by opening up participatory schemes among organized sectors of the community, including business organizations; by offering systematic and timely technical assistance, including the dissemination of information; by encouraging community participation in technical cooperation programs that use evaluation schemes; by facilitating the involvement of other actors, especially academics and international programs; and by serving as a communications link between communities and their institutions.

Support should be given to Latin American and Caribbean network initiatives in which communities share their experiences and access technical assistance programs. Government, academic and research institutions, and economic development sectors, should all be involved. The network should be entrusted to the headquarters of a regionally recognized institution that has well-defined objectives, clear work plans, precise performance and evaluation indicators, and budgetary resources to cover its operation.

Review of references of Market-Based Instruments with Potential Application to Solid Waste Management in Latin American Countries[20]

The following table is organized into three main categories, namely:

- Revenue Generating Instruments
- Revenue Providing Instruments
- Non Revenue Instruments

For each country noted as a place where the instrument has been reported as being used, the references can be found on pages 15 to 25 of this Appendix.

[20] This section was written by Sandra Cointreau and Constance Hornig, with contributions from Maya Cointreau, Nancy Cunningham.

REVENUE GENERATING INSTRUMENTS		
Categories of Economic Instruments	**Definitions and Comments**	**Countries Where Use of the Instrument has been Reported in the Literature Referenced[21]**
CHARGES:		
Pollution Charges	A fee charged to the polluter that varies with the quantity (total loading) and/or concentration (loading per unit ofreceiving stream) of pollutants discharged. The fee is subsequently designed to cover environmental improvements. For example, taxes on fuel based on the lead content, fees on wastewater effluent based on pollutant loading.	Canada (142), Lithuania (118), Brazil (113), Colombia (113), Jamaica (113, 57), Mexico (113, 13, 70), Costa Rica (13), Uruguay (13), Colombia (13), Germany (41), Portugal (147), Macedonia (76), China (90, 70), Taiwan (55), The Philippines (91, 70), Egypt (70), Korea (70), Kazakhstan (70), OECD (70), Brazil (70), The Netherlands (70)

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[21] *Reference numbers are noted within parentheses () following each country where the instrument has been reported.*

REVENUE GENERATING INSTRUMENTS *(continued)*

Categories of Economic Instruments	Definitions and Comments	Countries Where Use of the Instrument has been Reported in the Literature Referenced[21]
Waste Generation Charges (Variable rate user charges)	A fee on waste generation, based on polluter-pays principle, and aimed to affect waste generation. Solid waste generation is usually discussed in terms of weight, as it is readily compactable at different stages of storage, transport, and disposal. Nevertheless, waste generation charges may be administered by volume (or number of containers of a specific size) for ease of accounting.	Barbados (113), Bolivia (113), Brazil (113, 70), Chile (113, 70), Colombia (113, 70), Ecuador (113), Jamaica (113), Mexico (113, 70), Trinidad and Tobago (113), Venezuela (113), Japan (36, 49), British Columbia (68), Jamaica (57), Slovak Republic (46), United States (77), The Netherlands (60), China (70), Indonesia (70), Malaysia (70), Singapore (70), Thailand (70)
Waste User Charges	A fee for the payment of service, specifically for collection service, but often designed to cover all service costs, usually based on the ability to pay, size of the property, and level of commercial activity at the property. Collected alone, or tied to water or electricity bills.	Bosnia & Herzegovina (118), Bulgaria (118), Croatia (118), Czech Republic (118), Estonia (118), Hungary (118), Latvia (118), Romania (118), Slovenia (118), Yugoslavia (118), Ecuador (107, 70), Korea (13,107, 41), Singapore (13,107), Indonesia (13,107), Ghana (107), U.S. (13, 41), Canada (41,111), Taiwan (41), Lithuania (95), Poland (95), Slovak Republic (95), Jamaica (57), Bolivia (129), New Zealand (82), Vietnam (87), Portugal (147), Ireland (146), Israel (88), Commonwealth of the Northern Mariana Islands (128), Japan (49), Greece (145), Colombia (113), Venezuela (70), Thailand (70), Canada (30), Switzerland (148, 28), Netherlands (28), Belgium (28)

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[21] *Reference numbers are noted within parentheses () following each country where the instrument has been reported.*

REVENUE GENERATING INSTRUMENTS *(continued)*

Categories of Economic Instruments	Definitions and Comments	Countries Where Use of the Instrument has been Reported in the Literature Referenced[21]
Waste Tipping Charges	A fee for the payment of unloading service, specifically for transfer, treatment, and/or landfill service. Tipping refers to the collection truck unloading at the service facility. Waste generators may pay for these charges within their waste user or waste generation charges, and their service provider may be directly charged for tipping. Some individuals and business have no service provider and go directly to unload with their own vehicles, thus some tipping fees are necessary at the facilities receiving such loads. Tipping charges at sites can vary greatly and thus influence the distance that waste is transported within a region. Funds from fees can be targeted to specific uses. For example, in Pennsylvania a fixed amount per ton is added to charges and placed in a Recycling Fund.	Czech Republic (118), Estonia (118), Latvia (118), Slovak Republic (118),0 U.S. (13), (Barbados) (113), Chile (113, 129), Ecuador (113), Canada (41, 30), Poland (95), Hungary (95), Romania (95), Venezuela (129), New Zealand (82), Australia (72), Guam (130), Commonwealth of the Northern Mariana Islands (128), Japan (49), Greece (145), France (70), United Kingdom (70, 28), Turkey (107), Austria (28), Italy (28), Pennsylvania (63, 101, 102)
Product Charges	Special fees for handling products with difficult disposal requirements or adverse environmental impacts, e.g., batteries/accumulators, refrigerators and refrigerants, lubricants, tires, substances/products damaging the ozone layer (CFCs), mineral oils.	Hungary (4, 118), Latvia (4, 118), Korea (41), United States(41), Bulgaria (95), Slovak Republic (95), Lithuania (95),Jamaica (57), Japan (49), Korea (120), China (70), OECD (70), Thailand (70), Denmark (70), Bangladesh (70)
Fee Reduction for Recycling	A fee for service or waste generation is reduced upon proof of efforts for recycling or reuse.	Argentina (13)
TAXES:		
Waste Treatment or Disposal Tax	Differentiated tax per ton of waste for final treatment and/or disposal, with lower taxes charged for more environmentally friendly treatment or disposal methods.	Austria (8), Denmark (8), Norway, 8), UK (8)
Landfill Tax	A tax on business activities or waste weight/ volume discharged that is directed toward safe disposal.	Italy (4), Netherlands (4), Sweden (4), U.K. (4, 13, 8), Turkey (107), Latvia (107), Slovak Republic (46), France (78), Scotland (58), Ghana (107), Barbados (1), U.S. (110)

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[21] *Reference numbers are noted within parentheses () following each country where the instrument has been reported.*

REVENUE GENERATING INSTRUMENTS *(continued)*

Categories of Economic Instruments	Definitions and Comments	Countries Where Use of the Instrument has been Reported in the Literature Referenced[21]
Pollution Tax	A tax charged to the polluter that varies with the quantity and/or concentration of pollutants being emitted—where revenues collected *are not necessarily designated* for environmental purposes. For example: product taxes, taxes on ozone-depleting chemicals, carbon and sulfur taxes on fossil fuels, taxes on "gas guzzler" vehicles.	France (4), United Kingdom (4, 8, 13, 148), Denmark (41, 8), Italy (41, 148), United States (41, 13, 8), Australia (119, 8), Germany (119, 8, 148), Finland (119, 8), Netherlands (119, 8, 148), Norway (119, 8), Sweden (119, 13, 8, 148), Slovak Republic (46), The Philippines (91), Japan (75), Thailand (13), Barbados (1)
Presumptive Tax	Tax based on presumed levels of pollution from specific polluters. An effluent charge that is sensitive to a presumed level of pollution. A firm is compelled to pay the tax, and no specific monitoring is conducted. If the firm wishes to reduce its tax burden, it must conduct monitoring at its own expense (but still subject to regulatory audit) to demonstrate that its actual pollution loads are less than the presumed loads.	Guyana (113)
Eco-tax	Taxes to generate incentives for industrial change to save energy and decrease pollution, with funds earmarked for renewable energy promotion and other environmentally positive changes. For example: non-renewable production, aviation fuel or other polluting activities. Also applied to tourism to address the environmental impact of significant tourism. Could also be applied to industries that use virgin materials, as a means of motivating use of recycled materials.	Belgium (ref 3 in 4, 62), France (4), Latvia (ref 27 in 4, 118), Denmark (ref 10 in 4, 8), Estonia (4, 118), Hungary (4, 118), Finland (4), Sweden (4, 71), Norway (4, 8), Germany (92, 8), energy Basque Autonomous Community (71), Balearic Islands (47, 2, 28), Greece (8), Portugal (8), Turkey (8), Korea (8), Luxembourg (8), Ireland (21), Finland (10)
Conventional Tax	This might include value-added tax, property tax, gasoline tax. A portion could be set aside for covering solid waste costs or improving environmental issues related to solid waste management.	Brazil (113), Colombia (113), Mexico (113), Czech Republic (118), Estonia (118), Hungary (118), Poland (118), Romania (118), Slovak Republic (118), Macedonia (118), Yugoslavia (118)

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[21] *Reference numbers are noted within parentheses () following each country where the instrument has been reported.*

REVENUE GENERATING INSTRUMENTS *(continued)*

Categories of Economic Instruments	Definitions and Comments	Countries Where Use of the Instrument has been Reported in the Literature Referenced[21]
Taxes to Encourage Reuse or Recycling of Problem Materials	Includes differentiated taxes on refillable versus non-refillable beverage containers, and could be applied to other packaging.	British Columbia (68), Norway (8), Finland (8)
Natural Resource Tax	Tax on virgin materials or natural resources used in manufacturing or transport of manufactured goods that would affect their final costs and thus influence market preferences (including preferences for products with recycled material content), including taxes on water, fuel, trees, and various metals, minerals, pesticides and volatile organic compounds.	Brazil (113, 13, 113), Colombia (113), Venezuela (113), Ecuador (113), (Mexico) (113), Slovak Republic (46), The Philippines (91), Czech Republic (118), Estonia (118), Hungary (118), Latvia (118), Lithuania (118), Macedonia (118), Poland (118), Romania (118), Slovak Republic (118), Slovenia (118), Yugoslavia (118), Vietnam (124), China (50), Israel (107), UK (13), Denmark (8), Belgium (8), Canada (8), Norway (8), Netherlands (8), US (8), Finland (8), Sweden (8), U.K. (8)
Subsidy Elimination/ Reduction	Reduction of subsidies for fertilizer and pesticide, impacting on marketability of compost. Reduction of subsidies for incineration, impacting on the cost viability of sanitary landfill. Reductions of subsidies for natural resources, such as forest wood, influencing the decisions to recycle.	Ex-Soviet Union (107), Viet Nam (107), China (107, 70), Bangladesh (70), India (70), U.K. (8), Belgium (8), Portugal (8)

[21] *Reference numbers are noted within parentheses () following each country where the instrument has been reported.*

REVENUE PROVIDING INSTRUMENTS		
Categories of Economic Instruments	**Comments**	**Countries Where Use of the Instrument has been Reported in the Literature Referenced [22]**
FISCAL INCENTIVES AND PROPERTY RIGHTS:		
Credit Subsidy	Low interest credit lines or longer-term payback loans for projects that improve waste managementand/or increase private investment, including special project financing from development agencies.	Barbados (113), Brazil (113), Colombia (113), Ecuador (113), Mexico (113), India (13,107), U.S. (136)
Environmentally Relevant Tax Allowances and Exemptions	Accelerated property tax allowances, customs duty exemptions, and sales tax exemptions to motivate private investment in environmental equipment and technology.	Bulgaria (118), Croatia (118)
Tax Relief	Tax reduction provided as a financial incentive for private investors to improve environmental conditions.	Barbados (113), Brazil (113, 70), Chile (113, 70), Ecuador (113, 70), Jamaica (113), Venezuela (113), U.S. (106, 13), (Japan) (139), Portugal (147), Ireland (146), China (70), Colombia (70), India (70), Korea (70), Mexico (70), The Philippines (70)
Fiscal Compensation for Preservation Areas (Water Supply and Ecosystem Areas)	Tax to compensate municipalities for land-use restrictions based on environmental reasons, which could affect the cost of virgin materials or natural resources (and thus the economics of recycling).	Brazil (113)
Abatement Investment Tax Credits	Polluting businesses must register, and they become eligible for refundable tax credits when purchasing new equipment that generates less waste.	Canada (41), United States (41), The Philippines (91), Brazil (113), Mexico (113), Colombia (113), Barbados (113), Chile (113), Ecuador (113), Caribbean (113)
Tax Rebate for Energy Efficiencies or Pollutant Savings	Could affect choices of fuels, which could subsequently affect the economics of waste-to-energy systems, including refuse-derived fuels that are lower in some air emissions.	Denmark (8)
Development Rights	Granting development rights to private investors that conduct clean-up of contaminated lands or preserve the environment; this can be useful for obtaining investment in remediating old dumpsites (as done in Manila, the Philippines).	Philippines (107), United States (144)

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[22] *Reference numbers are noted within parentheses () following each country where the instrument has been reported.*

REVENUE PROVIDING INSTRUMENTS *(continued)*		
Categories of Economic Instruments	**Comments**	**Countries Where Use of the Instrument has been Reported in the Literature Referenced [22]**
Long Term Use of Government Land or Facilities or Leasing or Government Equipment	Allows the private sector to use government lands to build solid waste facilities.	Ivory Coast (107), Ghana (107), India (107), Indonesia (107)
Fiscal Incentives for Industry	These can include, for example, (a) assistance with project financing, (b) 10-year tax holidays, (c) relief from multiple taxation, (d) leasing of property, (e) marketing support, and (f) training and support organizations.	Barbados (113), U.S. (13), Brazil (112), The Netherlands (44), Belgium (38), France (40), Ireland (40), United Kingdom (40), Malta (153)
HOST COMMUNITY INCENTIVES:		
Host Community Compensation	Trust funds for potential environmental degradation or other adverse impacts from a waste management facility. Compensation in the way of direct payment, new infrastructure, waived tipping fees, and promised jobs for hosting a waste management facility. These funds can be used to provide grants to reimburse the developmental and operational costs of enhancements to waste management practices, e.g. removing hazardous wastes from the waste streams.	U.S. (106, 105, 42), Philippines (107), Latvia (107)
Host Community Authorizations	Communities may be more willing to accept treatment or disposal of wastes from other communities if they are provided the opportunity to establish arrangements they can live with. Pennsylvania is attempting to get this policy in place.	U.S. (67)
FUNDS AND GRANTS:		
Environmental Funds	General funds to support safe disposal and environmental improvements.	Bulgaria (118), Estonia (118), Macedonia (118), Romania (118), Latvia (107), Nepal (41), Peru (41), Poland (41), Germany (41), Egypt (41), Vietnam (41, 87), United Kingdom (41), United States (41), The Netherlands (41), Denmark (41), Canada (41), Thailand (94, 84), Commonwealth of the Northern Mariana Islands (128), India (56), Slovak Republic (46), China (83), Czech Republic (39), Macedonia (76), Greece (145), Tunisia (121)

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REVENUE PROVIDING INSTRUMENTS *(continued)*

Categories of Economic Instruments	Comments	Countries Where Use of the Instrument has been Reported in the Literature Referenced [22]
Clean-Up Funds	The U.S. Superfund was created to clean up contaminated hazardous waste sites and those with conditions hazardous to health and safety.	U.S. (107)
Carbon Fund	The World Bank's Prototype Carbon Fund provides for greenhouse gas emission reduction transactions, including cleaner technologies, support of areas of special biodiversity, carbon offset trading. A fund in the Netherlands specifically allows carbon offsets by landfill gas improvements to be applied against industrial emissions.	Brazil (125), Mexico (125), Netherlands (107)
Recycling Fund	A fund specifically focused on promoting and improvingrecycling. The source of the monies includes a fixed fee per ton added to waste tipping fees.	U.S. (101)
Research Grants	Grants, contracts, subsidies for improvement in technologies and study of environmental controls.	U.S. (107, 6)

[22] *Reference numbers are noted within parentheses () following each country where the instrument has been reported.*

NON REVENUE INSTRUMENTS		
Categories of Economic Instruments	**Comments**	**Countries Where Use of the Instrument has been Reported in the Literature Referenced [23]**
TRADE-OFF ARRANGEMENTS:		
Tradable Recycle or Waste Certificates	A certificate, token, or other commodity given in return for a unit of recyclable or waste material brought to a collection or buy-back location.	UK (4), Germany (4), Brazil (107), United States (48), Australia (97)
Tradable Emission Permits Based on Fuel Use, Water Extraction or Pollutant Discharge	Tradable permits allow a cap on total emissions from a particular class of sources. Companies that reduce emissions below the level required by law receive emissions credits (allowances) that can be traded for higher emissions elsewhere, thus enabling pollution reductions at companies where they can be made most cost-effectively. For example, at a power plant, pollution can be reduced by switching part of power generation to renewable energy, rather than reducing emissions from another part that uses fossil fuel.	Mexico (113), Chile (113), Germany (45), United States (116, 13, 1, 106), Japan (116), Canada (13, 142), (Japan) (139), Slovenia (118), New Zealand (134), (Bolivia) (113), Chile (113)
Carbon Sequestration	Encourages the private sector to use its resources and innovations to reduce greenhouse emissions and promote sustainable development worldwide by purchasing threatened park lands from private owners and non-governmental organizations and transferring them to their country's ownership for permanent protection.	Costa Rica (41, 51), United States (41, 51), Portugal (115), The Netherlands (115), Belize (51), Malaysia (51), Guatemala (51), Czech Republic (51), Russia (51), Bolivia (51), Mexico (51), Uganda (51), Ecuador (51), Peru (51), Paraguay (51), Brazil (113)
LIABILITY MEASURES:		
Liability Insurance or Damage Assessment Requirements	Insurance requirements and liability financial assurances to enable compensation for damages are made due toenvironmental impairment and/or adverse impacts to health and safety.	Bolivia (113), Colombia (113), Trinidad and Tobago (113), U.S. (106,105)
Bond and Trust Performance Requirements	Guarantees of compliance with construction and operating standards and environmental requirements, which are then refunded when compliance is achieved.	U.S. (13,106, 105), New Zealand (114)

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[23] *Reference numbers are noted within parentheses () following each country where the instrument has been reported.*

NON REVENUE INSTRUMENTS *(continued)*

Categories of Economic Instruments	Comments	Countries Where Use of the Instrument has been Reported in the Literature Referenced [23]
Long-term Performance Bonds	These bonds are posted for potential or uncertain hazards from infrastructure construction and/or after closure, and particularly applied to long-term impacts related to landfills after closure. Requirements for operators to post long-term "performance bonds" have often been used for mining or logging projects, which may require some reclamation or reforestation at an future date; similar performance bonds can be applied to road construction, pipeline construction, or oil tankers potentially affecting water resources.	U.S. (106, 105), Australia (121), Indonesia (121), Sweden (121)
Legal Redress and Advocacy		Trinidad and Tobago (113), Colombia (113), Malawi (65)
Liability Legislation	The polluter or resource user is required by law to cover environmental damage—for example, restoration after site contamination and biodiversity damage—as well as damage to health and property. Damaged parties collect settlements through litigation and the court system.	Greece (104), Italy (104), Luxembourg (104), The Netherlands (104), Portugal (104), Finland (104), Sweden (104), Norway (104), Spain (104), France (104), Austria (104, UK (104), Japan (121), U.S. (106)
Insurance Pools	Most insurance is tied to sudden and accidental damage. Insurance pools that extend to gradual damage through pollution enable pollution risks to be covered.	Denmark (104), Spain (104), France (104), Italy (104), Netherlands (104)
Remediation Liens	A lien can be placed on state-remediated property up to the amount the market value of the property increased—for example, where a waste tire pile was remediated.	U.S. (37)
PERFORMANCE DISCLOSURE:		
"Zero Net Impact" Requirements	Its intent is to ensure that, if some unavoidable environmental disruption is caused in one area, a compensating investment is undertaken elsewhere. For example, if a disposal site affects a wetland in one area, a new wetland can be created in another.	Latin America (113), U.S. (107)

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[23] *Reference numbers are noted within parentheses () following each country where the instrument has been reported.*

NON REVENUE INSTRUMENTS *(continued)*

Categories of Economic Instruments	Comments	Countries Where Use of the Instrument has been Reported in the Literature Referenced [23]
Disclosure Legislation Requiring Manufacturers to Publish Solid, Liquid, and Toxic Waste Generation	Firms are required to publish precisely what they pollute. There are no sanctions attached to such disclosure but consumers are then given the choice of how to deal with the products of particular firms.	United States (151), Australia (151), Austria (151)
Manifest Systems	Cradle-to-grave documentation of a waste material from the point of generation, through each transport and handling step, to ultimate disposal.	U.S., Canada (54), Indonesia (135), South Africa (122)
Product Life Cycle Assessment and/or Management	Considers the whole life cycle of a product and attempts to predict overall environmental burdens associated with providing a product (or service) on a cradle-to-grave basis. Involves waste minimization and source reduction efforts, including reduced packaging usage. EMAS (Eco-Management and Audit Scheme) certification and ISO 14000 certification provide for some aspects of life cycle assessment.	Germany (33), Canada (33), U.S. (19)
Blacklist of Polluting or Exploitive Companies	List of companies to be banned by consumers for reasons of their environmental performance, corrupt practices, or other negative behavior.	U.S. (13, 35, 22, 80), Ireland (29)
Ranking Based on Environmental Criteria	Published rankings of companies and/or municipalities based on scores from criteria such as increasing recycling, use of hazardous materials in production, extended producer responsibility, take-back, life cycle assessment.	U.S. (31, 34), Canada (32, 15)
Public Disclosure of Solid Waste Management Practices	Information is published on operations and on various performance measures such as statistics on recycling, landfill statistics, waste-to-energy statistics, etc.	U.S. (63, 80)

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[23] *Reference numbers are noted within parentheses () following each country where the instrument has been reported.*

NON REVENUE INSTRUMENTS *(continued)*

Categories of Economic Instruments	Comments	Countries Where Use of the Instrument has been Reported in the Literature Referenced [23]
DEPOSIT-REFUNDS:		
Deposit-Refund Systems	Deposit for a product to cover waste recovery and/or treatment, e.g. tire deposit. Refund for some positive action, e.g., refund for returning recyclable bottle or aluminum can. Deposit refund systems lead to return of car and van hulks for recycling, return of refrigerators for proper disposal of chlorofluorocarbons, and return of batteries for safe disposal.	Barbados (113, 1), Bolivia (113), Brazil (113, 70, 113), Chile (113, 70), Colombia (113, 70), Ecuador (113, 70), Jamaica (113, 70, 113), Mexico (113, 70, 1, 113), Peru (113), Trinidad and Tobago (113, 13), Venezuela (113, 70), Croatia (118), Bosnia & Herzegovina (118), Estonia (118), Hungary (118), Lithuania (118), Poland (118), Romania (118), Slovak Republic (118), Yugoslavia (118), U.S. (13, 70), Taiwan (41, 70), China (70), Korea (41, 120, 13), Japan (126, 120, 70), Czech Republic (95), Jamaica (57), Taiwan (120), The Philippines (91, 70) Bangladesh (70), Finland (70), Norway (70, 8), Sweden (70), Canada (8), Denmark (20), Austria (4,28), Germany (4,142, 28), Netherlands (28), Japan (16), Taiwan (16) Switzerland (142), Ireland (4), Switzerland (4), France (4), Portugal (4), Spain (4)
Product Stewardship Policies	Policies to encourage companies to include the costs of reuse, recycling or disposal in the price of the product; to take actions to improve design and manufacture to facilitate reuse, recycling or disposal; and to take actions to establish programs to collect, process and reuse/recycle products when discarded.	U.S. (137)
Take-Back Systems for Solid Waste	Producer takes back used products for purposes of refurbishing and/or recycling. Such schemes are also appropriate for difficult problems such as toxic and hazardous waste management.	Philippines (13), U.S. (31, 9), Taiwan (120), Japan (120), Germany (62), France (62)

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[23] *Reference numbers are noted within parentheses () following each country where the instrument has been reported.*

NON REVENUE INSTRUMENTS *(continued)*

Categories of Economic Instruments	Comments	Countries Where Use of the Instrument has been Reported in the Literature Referenced [23]
PROCUREMENT POLICIES:		
International Trade Policy Revisions	Trade policies typically encourage lower polluting industries and current international trade protocols tend to encourage environmentally responsible production policies in countries of origin, many of which are developing countries. In addition, local subsidies that decrease import tariffs for environmental technologies can have a positive environmental impact.	Canada (142), U.S. (8), Mexico (113), Barbados (113)
Recycled Content	Laws mandating specified percentages of recycled materials used in manufacture of new products, to stimulate recycled materials markets.	U.S.(138)
Procurement Preferences	Requiring governmental procurement preferences for purchase of recycled content products, i.e., evaluation points to responsive bidders.	U.S. (140)
Development of Procurement Specifications	Developing procurement specifications to promote use of recyclable materials and minimize waste generation.	U.S. (103)
Licensing of Waste Management Operators	Licensing criteria and procedures enable a level playing field for competition, specifically for private subscription of service directly with waste generators. Facilitates investment in special waste systems, such as biomedical wastes, construction/demolition debris, and hazardous wastes.	U.S. (13), Ghana (107)
Performance-Based Management Contracts	Private sector take-over of service responsibilities with contracts based entirely on improvements toward specific performance targets.	Kosovo (107), U.S. (106)
Cost-Based Accounting and Transparency, and Management Information Systems	Change in accounting procedures and transparency to enable performance review and encourage improved cost-effectiveness.	Ghana (107), San Salvador (107)

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[23] *Reference numbers are noted within parentheses () following each country where the instrument has been reported.*

NON REVENUE INSTRUMENTS *(continued)*

Categories of Economic Instruments	Comments	Countries Where Use of the Instrument has been Reported in the Literature Referenced [23]
Labor Law Changes	Changes in labor retention requirements, minimum wages, severance pay requirements, public job protections, etc., that affect the ability of the government to reduce redundant workers and the private sector to hire workers.	India (107), Ecuador (107)
Managed Competition	Arrangements to facilitate competition between the public and private sector so that contestability is optimized and cost effectiveness among all is achieved.	U.S. (106,105), U.K. (107), Canada (61)
Technology Requirement	Specific demand for a type of technology, such as composting, for a specifictype of waste. Motivated substantial private sector investment in composting in India.	Denmark (107), India (107)
COMMUNITY MOTIVATORS:		
Clean City Competitions	Competitions that motivate political leaders and individuals to improve their overall waste management.	Indonesia (107)
Assisted Initiatives	Efforts by community groups, private entrepreneurs and non-profit organizations to initiate new systems with direction and assistance from government.	Japan (36), India (41), Jamaica (41)
Environmental Fairs and Events	Events that motivate attending individuals to improve their overall waste management through games, hikes, etc.	Australia (92), Japan (36), Singapore (41), Ghana (107), Nigeria (107)

[23] *Reference numbers are noted within parentheses () following each country where the instrument has been reported.*

TABLE REFERENCES:

1. "A Review of Economic Instruments and Methodologies for Meeting Environmental Goals," Caribbean Planning for Adaptation to Climate Change—Component 8, National Oceanic and Atmospheric Administration, U.S. Dept. of Commerce, June 2000.
2. "Balearics Eco-tax Wins EU Approval," Balearics Regional Government, (http://www.environmentdaily.com/articles/ndex.cfm?action=article&ref=12696).
3. "Duty Reduction for Pollution Control Equipment," Ministry of Finance, Thailand, (http://www.ostc-was.org/environment/duty.html).
4. "Economic Instruments in Packaging and Packaging Waste Policy," EUROPEN: the European Organization for Packaging and the Environment, October 2000, 21 p.
5. "Economic Instruments to Control Pollution", November 1996, (http://www3.symatico.ca/david.macleod/EPOLL.htn).
6. "Electronic Tags for Product Lifecycle Management," Grant description for a research project, Princeton University and US Environmental Protection Agency, (http://es.epa.gov/ncerabstracts/grants/01/sustain/thomas.html).
7. "Environmental Liability Proposals," Commercial Angles Newsletter, June 2001, (http://www.commercialangles.com/articles/environmental.liability.htm).
8. "Environmentally Related Taxes in OECD Countries: Issues and Strategies," OECD Code 972001101E1, Paris, France, 2001, 142 p.
9. "Extended Producer Responsibility," Environmental Manager, Volume 10, No. 1, August 1998, (http://www.informinc.org/epr.htm).
10. "Finnish Government to Double Waste Taxes," Finnish Environment Ministry, 2002, (http://www.environmentdaily.com/articles/ndex.cfm?action=article&ref=12695).
11. "German Packing Regulations," Commercial Angles Newsletter, September 2001, (http://www.comercialangles.com/articles/green.dot.htm).
12. "Germany's Green Dot Program."
13. "Global Environment Outlook", Chapter Three—Policy Responses, United Nations Environmental Program, 2000, (http://www1.unep.org/GEO-2000/english/index.htm).
14. "Greening Your Purchase of Electronics," US Environmental Protection Agency, Environmentally Preferable Purchasing—Success Stories, (http://www.epa.gov/opptintr/epp/documents/electronics/eletronic33.htm).
15. "Imports of Hazardous Waste Decline in 2000," Environment Canada, (http://www.ec.gc.ca/Press/2001/010803_n_e.htm).
16. "Japan and Taiwan (China): Deposit-Refund Systems for Solid Waste Recycling," Pollution Control Using Markets, World Bank, (http://wbln0018.worldbank.org/essd/eeipm.nsf/c0219bb8ef063b4c8525663b00657a5d/).
17. "Manual on Municipal Solid Waste Management," Government of India Expert Committee, May 2000, 755 p.
18. "Municipal Waste Planning, Recycling and Waste Reduction Act of the Commonwealth of Pennsylvania," U.S. State of Pennsylvania Act 1988–101.
19. "National Source Reduction Characterization Report for Municipal Solid Wastes in the United States," US Environmental Protection Publication 530-R-99-034, November 1999, 80 p., (http://www.epa.gov/epaoswer/non-hw/reduce/r99034.pdf).
20. "New Returns System Ends Danish 'Can Ban'," Danish Environment Ministry, (http://www.environmentdaily.com/articles/ndex.cfm?action=article&ref=12735).
21. "New Tax Slashes Irish Plastic Bag Consumption," Irish Environment Ministry, 2002, (http://www.environmentdaily.com/articles/index.cfm?action=article&ref=12715).
22. "Nigeria's Drilling Fields," "Amazon Oil Offensive," and others in the journal Multinational Monitor, which exposes companies harming the environment and humanity, January/February, 1995, (http://multinationalmonitor.org/hyper/mm0195.html).
23. "Option for Environmental Taxes Considering Global Warming," Last Report of the Research Panel on Economic Instruments, Japan Environment Ministry, 1995, (http://www.env.go.jp/en/rep/tax/index.html).
24. "Promoting the Greenhouse Gas Market Through Research, Outreach and Training," World Bank Prototype Carbon Fund, homepage and access to projects, (http://prototypecarbonfund.org/router.cfm?Page=PCFPlus).
25. "Recycling Credits in the U.K.," Winnipeg Industrial Institute for Sustainable Development, Canada, 1996, (http://iisd1.iisd.ca/greenbud/credits.htm)

26. "Regulatory and Economic Instruments to Reduce Groundwater Abstraction—Jakarta, Indonesia."
27. "Report of the Working Group on Economic Instruments," progress document, United Nations Environment Program, Geneva, Switzerland, February 2002, (http://www.unep.ch/etu).
28. "Study on the Economic and Environmental Implications of the Use of Environmental Taxes and Charges in the European Union and its Member States," Ecotec, Brussels, Belgium, April 2000, 51 p., (http://www.ECOTEC.com).
29. "The Black List," Environmental Watch Ireland, (http://www.home.zonnet.nl/ireland22/black11.htm).
30. "The User Pay Waste Management Initiative in the Victoria Capital Regional District, B.C.," Winnipeg Industrial Institute for Sustainable Development, Canada, 1996, (http://iisd1.iisd.ca/greenbud/userpay.htm).
31. "Third Annual Computer Report Card—Computer TakeBack Campaign," Clean Computer Campaign, Silicon Valley Toxics Coalition, November 2001, (http://www.svtc.org/cleancc/pubs/2001report.htm).
32. "Transboundary Movement Branch," Environment Canada, (http://www.ec.gc.ca/tmb/eng/tmbhp_e.html).
33. "Use of Life Cycle Assessment (LCA) as a Policy Tool in the Field of Sustainable Packaging Waste Management," EUROPEN: the European Organization for Packaging and the Environment, September 1999, 8 p.
34. "Waste Reduction Record-Setters—Program Profiles," Institute for Local Self-Reliance, Washington, DC, U.S., November 1998, 18 p., (http://www.ilsr.org/recycling/wrrs/profiles.html).
35. "World Bank Corruption Blacklist," World Bank Development News, November 2000, September 2002; "World Bank: Eight Firms, Two Individuals Debarred for Corruption in Contracts," World Bank Development News, April 2001, cited by Vinod, H.D., (http://www.fordham.edu/economic/vinod/cie/cie_news.html).
36. "2001 Environmental White Paper: The Environment of Mie Prefecture," Mie Environmental Study and Information Center, 2001, (http://www.eco.pref.mie.jp/data-syu/hakusho/1103/english/).
37. "Act 190—Waste Tire Recycling Act As Amended by Act 111 of 2002," July 10, 2002, (http://www.dep.state.pa.us/dep/deputate/airwaste/wm/MRW/Tires/SUMHB754P81132.DOC).
38. "Analysis of the Legislation Regarding Renewable Energy Sources in the E.U. Member States: Report Concerning Fiscal Measures In Belgium," PRISM, 2002, (http://www.jrc.es/cfapp/eneriure/Reports/BEL%20fin.pdf).
39. "Brno City Government 1999: Environment," Czech Department of Internal Affairs, 2000, http://www.brno-city.cz/main/odbory/ozv/government/environment-en.htm).
40. "CHP: Implementation Support Measures and Effectiveness," The Atlas Project, The European Commission, 2002, (http://europa.eu.int/comm/energy_transport/atlas/htmlu/ssschpmarpo4.html).
41. "Compendium of Instruments," International Institute for Sustainable Development, 2002, (http://iisd.ca/susprod/browse.asp).
42. "Costs & Funding Options: Household Hazardous Waste Grants," Act 155, (http://www.dep.state.pa.us/dep/deputate/airwaste/wm/HHW/Facts/grants.htm).
43. "Criteria for Screening and Assessing Administrative Penalties," Iowa Environmental Protection Agency, United States, 2002, (http://www.epa.gov/region07/programs/artd/air/rules/iowa/567-1002.pdf).
44. "Dutch Ministry of Economic Affairs—Policy," Biomaster, 2000, (http://www.biomasster.nl/en/pol/pol1.html).
45. "Economic Aspects of Sustainable Development in Germany," provided by the Government of Germany to the United Nations Commission for Sustainable Development, 1998, (http://www.un.org/esa/agenda21/natlinfo/countr/germany/eco.htm).
46. "Economics of Environmental Protection: State Environmental Fund," State Of The Environment Report, Slovak Republic, Ministry of the Environment of the Slovak Republic, 1998, (http://www.sazp.sk/slovak/periodika/sprava/sprava98eng/4/prot/index.html).
47. "Eco-Tax of Tourism in Minorca," Sustainable Development International, 2000, http://www.sustdev.org/industry.news/042000/0028.shtml).
48. "Electric Supply Strategies: Option 1.3 – Renewable Portfolio Standard," Tellus Institute, 2002, (http://righg.raabassociates.org/Articles/RPS_Annex_4-3-02_final.doc).
49. "Environmental Performance Reviews: Japan," OECD, 2002, (http://www.oecd.org/pdf/M00024000/M00024090.pdf).

50. "Executive Summary of Proceedings on 2001 Tax Conference," Tokyo, Japan, 2001, (http://www.adbi.org/PDF/ess/e5.pdf).
51. "Forest and Land-Use Change Carbon Sequestration Projects," World Resources Institute, Washington, D.C., 2002, (http://www.wri.org/climate/sequester.html).
52. "Green Dot Background," Green Dot Canada, (http://www.greendot.ca/More%20Info/background.htm).
53. "Indonesia – Tariff Measures," UNCTAD-TRAINS, 2000, (http://www.unctad.org/trains/2001%20Indonesia.htm).
54. "Industrial Activities: Waste Handling," Industry Canada, 2002, (http://www.bravo.ic.gc.ca/biotech/mining/mnwaste.htm).
55. "Investors Guide: Fees," Economic Processing Zone Administration, Kaohsiung, Taiwan, (http://www.kepz.gov.tw/kepz/enveroment2.nsf/pages/4).
56. "ISHA's Role Towards Blood Distribution, Clinical Waste, Infection Control, And Environmental Enrichment," Indian Society of Health Administrators, 1999, (http://www.ishaindia.com/html/blood.htm).
57. "Jamaica: National Environmental Action Plan," NEPA, 1995, (http://www.nepa.gov.jm/policies/neap/content.html).
58. "Landfill Tax," Scottish Wildlife Trust, 2002, (http://www.swt.org.uk/support_us/companyhelp/landfill.asp).
59. "Laws and Rules Relevant to Environmental Protection," Regional Environmental Information Management System in Tumen River Area, China, 2002, (http://tumen.com.cn/laws/main.htm).
60. "Levy on Surface Water Pollution in the Netherlands," Winnipeg: International Institute for Sustainable Development, 1996, (http://iisd1.iisd.ca/greenbud/nether.htm).
61. "Managed Competition: FAQ," Region of Peel Public Works, 2002, (http://www.region.peel.on.ca/pw/manfaq.htm).
62. "Managing Packaging Waste in Europe—Lessons for Australia," Packaging Council of Australia, 1993, ("http://www.packcoun.com.au/issues13.html" http://www.packcoun.com.au/issue35.html).
63. "Mid-Atlantic States Municipal Waste Matrix," Pennsylvania Department of Environmental Protection, May 1999, (http://www.dep.state.pa.us/dep/deputate/airwaste/wm/MRW/Docs/Tip_Fees.htm).
64. "More About Environmental Exports", Danish Environmental Protection Agency, Danish Ministry of the Environment, 2002, (http://www.mst.dk/homepage/default.asp?Sub=http://www.mst.dk/aid/02010000.htm).
65. "National Environmental Policy," Malawi SDNP, 1999, (http://www.sdnp.org.mw/~paulos/environment/policy/NEP4.htm).
66. "Office of Environmental Advocate," website, Pennsylvania Department of Environmental Protection, (http://www.dep.state.pa.us/hosting/environmentaladvocate/workgroup.htm).
67. "Out-of-State, Out of Mind," Testimony of David E. Hess, Secretary, Pennsylvania Department of Environmental Protection, Before the U.S. Senate Environment and Public Works Committee, Washington, DC, March 20, 2002, (http://www.dep.state.pa.us/dep/hess/remarks/hessremarks032002.htm).
68. "Overview of Product Stewardship in British Columbia," Ministry of Water, Air and Land Protection, British Columbia, 2001, (http://wlapwww.gov.bc.ca/epd/epdpa/ips/).
69. "PEAN, Pennsylvania Environmental Assistance Network, Increasing Your Competitive Advantage," Current Brochure, (http://www.pean.state.pa.us/pean.pdf).
70. "Pollution Control—Using Markets," World Bank Group, (http://wbln0018.worldbank.org/essd/eeipm.nsf/a2eec6dcb539e2088525663c00579890/6e50eaf80962a3e085255663b0076fc73?OpenDocument).
71. "Progress Report 1998: Environmental Regeneration," Bilbao Metropol, Basque Autonomous Community, 1998, (http://www.b54.es/plan/stat/pr118_uk.html).
72. "Prosecution for Non-Payment of Tipping Fees, Kimbriki Recycling and Waste Disposal Center," Warringah Council Policy Manual, STR-PL 815, 2002, (http://www.warringah.nsw.gov.au/pdf/Policies/STR-PL_815.pdf).
73. "Public Participation Center," website, Pennsylvania Department of Environmental Protection, (http://www.dep.state.pa.us/dep/subject/public_desc.htm).
74. "Review of Performance During VII Five Year Plan and Goal Set For VIII Plan," Government of India, Ministry of Environment and Forests, 1994, (http://envfor.nic.in/pbudget/1994/chap-2a.pdf).
75. "Seiyu Plans to Tax CO2 Emissions," *The Asahi Shimbun*, 2002, (http://www.asahi.com/english/business/K2002061200589.html).

76. "State of Environment Report," The Republic of Macedonia Ministry of Urban Planning, Construction and Environment, 1998, (http://www.moe.gov.mk/soer2/seg_i_a.htm).
77. "Tax Tools for Climate Protection: The U.S. Ozone-Depleting Chemicals Tax," Winnipeg: International Institute for Sustainable Development, 1996, (http://iisd1.iisd.ca/greenbud/climate.htm).
78. "The Landfill Tax in France," Winnipeg: International Institute for Sustainable Development, 1996, (http://iisd1.iisd.ca/greenbud/landfill.htm).
79. "The Nebraska Environmental Trust," 2002, (http://www.environmentaltrust.org/index.html).
80. "Waste Haulers and Truck Drivers Fined More Than $2 Million for Violations During 'Operation Clean Sweep'," Press Release, Pennsylvania Department of Environmental Protection, October 11, 2001, (http://www.dep.state.pa.us/newsreleases/default.asp?ID=1267&varQueryType=Detail).
81. "Waste Transportation Safety Program" memo regarding Act 90, Pennsylvania State Legislature, June 29, 2002, (http://www.dep.state.pa.us/dep/deputate/airwaste/wm/MRW/Act90/WTSPmemo.doc).
82. "Waste: Quick Answers," Christchurch City Council, New Zealand, 2002, (http://www.ccc.govt.nz/QuickAnswers/Waste/index.asp).
83. "World Bank Support for Liaoning Province Urban Environment Programs," Liaoning International Conference on Urban Environment and Restructuring, 2002, (http://www.lneuwb.org.cn/EN/xmzc.htm).
84. Adulyadej, B. "The Enhancement and Conservation of the National Environmental Quality Act B.E. 2535," Pollution Control Department, Ministry of Science Technology and Environment, Thailand, 1992, (http://www.pcd.go.th/Information/Regulations/neqa/Full_NEQA.htm).
85. Ajakaiye, D.O., "Economic Policy Incentives and the Promotion of Environmentally Sustainable Development in Developing Countries," Ibadan, Nigeria, September 2001.
86. Andersen, M.S., "The Use of Economic Instruments for Environmental Policy—A Half-Hearted Affair," (http://www.iisd.ca/linkages/consume/sku.html).
87. Atinc, T.M., Lin, S., Johnson, A.,"Vietnam 2010: Entering the 21st Century," The World Bank Group, 2002, (http://www.worldbank.org.vn/vn_pillars/improve/improve006.htm).
88. Ayalon, O., Shechter, M., Avnimelech, Y., "Issues in Designing an Effective Solid Waste Policy: The Israeli Experience," The Market and the Environment: The Effectiveness of Market Based Instruments for Environmental Reform, 1999, (http://econ.haifa.ac.il/~shechter/SolidWas.htm).
89. Bans on disposal of "universal wastes" in municipal solid waste landfills (such as batteries, thermostats, lamps, and cathode ray tubes) as defined in California Code of Regulations, Title 22 §66273.9; bans on metallic discards (such as major appliances and vehicles) if recycling is economically feasible—California Integrated Solid Waste Management Act of 1989—Section 41261 *et seq.* of the California Public Resources Code, (http://www.ciwmb.ca.gov).
90. Baolin, H., "Enforcement of Pollutant Discharge Fee in China," Policy and Law Department, China National Environmental Protection Agency, (http://www.inece.org/4thvol1/baolin.pdf).
91. Batcagan, S., "Proposed Wastewater Discharge Permit Fees," Department of Environment and Natural Resources, Republic of the Philippines, 2000, (http://www.nscb.gov.ph/peenra/workshop/Technical%20Papers/Session%2011%20Policy-PrmtFee%20DENR.PDF).
92. Bentley, M., "Tracking Progress: Implementing Sustainable Consumption Policies," United Nations Environment Program and Consumers International, May 2002, (http://www.consumersinternational.org/campaigns/environment/Tracking%20Progress.pdf).
93. Bernstein, J., "Managing Hazard-Prone Lands in Third World Cities," World Bank Infrastructure Notes, Urban No. UE-6, March 1992, (http://www.worldbank.org/html/fpd/urban/publicat/rd-ue6.htm).
94. Bhumibol Adulyadej, R., "Enhancement and Conservation of National Environmental Quality Act," Thailand, (http://www.ostc-was.org/environment/environment.html).
95. Bizek, V., "Waste Management Policies In Central And Eastern Europe," DHV CR, 2000, (http://www.eurowaste.org)
96. Brück, W., "Duales—Packaging Recycling in Europe," Duales System Deutschland AG, (http:/

/www.packaging-technology.com/informer/productreview/product34/).

97. Carruthers, S., "Renewable Energy—Resources That Don't Cost the Earth!", Practical Hydroponics & Greenhouses Magazine, 2001, (http://www.hydroponics.com.au/back_issues/issue59.html).
98. Civil administrative penalties for failure to implement source reduction and recycling or household hazardous waste plans: California Integrated Solid Waste Management Act of 1989—Section 41850 of the California Public Resources Code, (http://www.ciwmb.ca.gov).
99. Cointreau, S., Gopalan, P., Coad, A., "Private Sector Participation in Urban Solid Waste Management—Guidance Pack (5 volumes), Swiss Technical Cooperation Agency, St. Gallen, Switzerland, 2000, (http://www.melissa.org/cwg/corebibliogaphy.htm).
100. Correa, M.E., "Changing Course in Colombia," United Nations Commission for Sustainable Development, 1998, (http://www.un.org/esa/sustdev/cppnt2.htm).
101. Correspondence to Pennsylvania Landfill Operators, from Director, Division of Municipal and Residual Waste Pennsylvania Department of Environmental Protection, July 30, 2002, (http://www.dep.state.pa.us/dep/deputate/airwaste/wm/MRW/Act90/DearLandfillOperator.doc).
102. Correspondence to Pennsylvania Landfill Operators, from Director, Division of Municipal and Residual Waste Pennsylvania Department of Environmental Protection, July 5, 2002, (http://www.dep.state.pa.us/dep/deputate/airwaste/wm/MRW/Act90/Disposalfeeletter.doc).
103. Develop specifications for purchase of compost by Departments of Forestry, Parks and Recreation and General Services, to maximize use of compost and diversion from disposal; review purchasing guidelines to identify impediments to increased procurement of recycled secondary and post consumer plastic products; develop standards for re-tread tires to increase their use and reduce disposal—California Integrated Solid Waste Management Act of 1989—Section 42230 *et seq.* and Section 42360 *et seq.*, Section 42410 *et seq.*, respectively, of the California Public Resources Code, (http://www.ciwmb.ca.gov).
104. Devries, C., Colliander, C., "White Paper on Environmental Liability," Directorate-General for the Environment, European Commission, European Community, 2000, (http://europa.eu.int/comm/environment/liability/el_full.pdf).
105. Direct information from officials in Philadelphia and Pennsylvania government by engineer Nancy Cunningham obtained during interviews in 2002 done specifically for this report.
106. Direct personal experience of Attorney Constance Hornig obtained during development of regulations, instruments, and contracts with cities and private operators in the U.S., 1980 to 2002.
107. Direct personal experience of engineer Sandra Cointreau obtained during field assignments on solid waste management to developing countries, 1980 to 2002.
108. Duer, H., "Economic Instruments in European Union Environmental Regulation—A Report for the Nordic Council of Ministers," COWIconsult, Denmark, 1994, 48 p.
109. European Commission 2000 Database on Environmental Taxes and Charges, European Commission, (http://europa.eu.int/comm/environment/enveco/env_database/austria2000.htm).
110. Fee based on amount, by weight or volumetric equivalent, of all solid waste disposed of at a disposal site: California Integrated Solid Waste Management Act of 1989—Section 48000 *et seq.* of the California Public Resources Code; and Integrated Waste Management Fee Law, Section 45001 *et seq.* of the California Revenue and Taxation Code, (http://www.ciwmb.ca.gov).
111. Gale, R.J.P., "Financial Pinch Leads Municipality to User Fees," Ecological Economics, 1996, (http://www.web.net/ecoeco/cs-user.htm).
112. Grieg-Gran, M., "Fiscal Incentives for Biodiversity Conservation: The ICMS Ecológico in Brazil," 2000, (http://216.239.51.100/search?q=cache:j4wIIcxP1toC:www.iied.org/pdf/DP_00-01.pdf+%22fiscal+incentives%22+%2Bwaste+%2Bincentives&hl=en&ie=UTF-8).
113. Huber, R., Ruitenbeek, J., Seroa Da Motta, R., "Market-based Instruments for Environmental Policy Making in Latin America and The Caribbean: Lessons from Eleven Countries," World Bank, 1998, (http://www.worldbank.org/nipr/work_paper/huber/huber2.pdf).
114. Hughes, B., "Recent Decisions—Week Ending 8/1/1999," New Zealand: Data Services Limited, 1999, (http://www.geography.otago.ac.nz/Geography/Resources/envnews/recent.decisions/1999/Rd080199.pdf).

115. International Carbon Sequestration Common Air Project, ING Bank, Rotterdam, The Netherlands, (http://www.wdw.nl/ENG/text/projects/damian/).
116. Ishi, H., "Regarding the Utilization of Economic Instruments such as Taxation and Charges in Environmental Policies," Environment Agency, Government of Japan, 1996, (http://www.env.go.jp/en/pol/etax/index.html).
117. Klarer, J., "Comparative Analysis of Economic Instruments for Environmental Protection Used in Bulgaria, the Czech Republic, Hungary, Poland, Romania, the Slovak Republic and Slovenia, December 1994, 160 p., (http://www.rec.org/REC/Publications/EcInstruments/overview.html).
118. Klarer, J., Francis, P., McNicholas, J., "Improving Environment and Economy: The Potential of Economic Incentives for Environmental Improvements and Sustainable Development in Countries with Economies in Transition," the Regional Environmental Center of Central and Eastern Europe, Szentendre, Hungary, July 1999, 83 p.
119. Krockenberger, M., "Taxing Waste, Not Work—Environmental Tax Reform," Australian Conservation Foundation, 2000, (http://www.acfonline.org.au/asp/pages/document.asp?IdDoc=31).
120. Lease, K., "Asian Countries Jump on the EPR Bandwagon," Institute for Local Self-Reliance, 2002, (http://www.ilsr.org/recycling/ftao/ftao41.html).
121. Market-Based Instruments in Environmental Policy in Developing Countries—Framework for Policy Planning and Institutional Development in the Environment," German Technical Cooperation Agency, March 1995, 40 p.
122. Mokaba, R., Borg, D., Wiechers, H., "National Waste Management Strategies and Action Plans, South Africa," 1999, (http://www.environment.gov.za/ProjProg/WasteMgmt/waste.html).
123. Montanari, A., Presas, T., "Sustainable Governance—Institutional and Procedural Aspects of Sustainability," European Consultative Forum on the Environment and Sustainable Development, Belgium, 2000.
124. Mundle, S., "Tax Reforms in Viet Nam: A Selective Analysis," 1998, Asian Development Bank, (http://www.adb.org/Documents/EDRC/Occasional_Papers/OP018.pdf).
125. Newcombe, K., "Making Carbon Finance Work for Conservation and Sustainable Development," Environment Matters—Annual Review of the World Bank, 2002 (for more details on the Prototype Carbon Fund see http://www.prototypecarbonfund.org).
126. O'Connor, D., "Japan: Deposit-Refund Systems for Solid Waste Recycling," The World Bank Group, 1994, (http://wbln0018.worldbank.org/essd/eeipm.nsf/c0219bb8ef063b4c8525663b00657a5d/da41ba18a4761d9b85256642004e8c5e?OpenDocument).
127. O'Connor, D., "The Use of Economic Instruments in Environmental Management: The East Asian Experience," OECD, 1994.
128. Palacios, A., Solid Waste Management Revolving Account Act of 2002, Commonwealth of the Northern Mariana Islands, 2002, (http://www.cnmihouse.gov.mp/billdir.php?Display=1&RefNo=210).
129. Panayotou, T., Lozano, D., Boscolo, M., "Environmental Regulation and Sustainable Development," 2000, (http://www.cid.harvard.edu/andes/Documents/Background%20Papers/Enviro%20Reg&Sustainable%20Devlpment.pdf).
130. Pangelinan, V., "An Act To Amend Subsections (C) And (E) Of §51118, Title 10, Guam Code Annotated, Relative To Establishing A Volume-Based Commercial And Residential Tipping/User Fees," Bill No. 122, Guam, 1999, (http://www.guam.net/com/senben/bills/25th%20bills/bill%20122.htm).
131. Pennsylvania Code, Title 25. Environmental Protection, Chapters 271–285. Municipal Waste, December 2000.
132. Pennsylvania Code, Title 25. Environmental Protection, Chapters 287–299. Residual Waste Management, January 2001.
133. Pennsylvania Environmental Education Grants Program, Pennsylvania Department of Environmental Protection, (http://www.dep.state.pa.us/dep/deputate/enved/EnviroEd/EnviroEdGrantsPro.htm).
134. Perkins, R., Calman, S., "Emissions Trading", Ministry of Economic Development, New Zealand, 2002, (http://www.med.govt.nz/ers/environment/climate/emissions/index.html).
135. President of Indonesia, "REGULATION REGARDING HAZARDOUS AND TOXIC WASTE MANAGEMENT: Government Regulation Number 19 of 1994", BAPEDAL, 1996, (http://law.nus.edu.sg/apcel/dbase/indonesia/regs/inrhaz.html).
136. Providing low interest loans to manufacturers that use post consumer waste materials as feed-

stock, to promote recyclables market development—California Integrated Solid Waste Management Act of 1989—Section 42000 *et seq.* of the California Public Resources Code, (http://www.ciwmb.ca.gov).

137. Quigley, A., Holland, P., Batchelder Adams, L., et al., "Proposed New SWANA Technical Policies: T31 – Product Stewardship and T32 – Solid Waste Disposal Bans," September 2001.
138. Recycled content legislation, such as requiring 10% post consumer recycled plastic in manufacture of plastic bags, to stimulate recyclables materials market development; post consumer content and recycling rates for rigid plastic containers—California Integrated Solid Waste Management Act of 1989—Section 42290 *et seq.* and 42300 *et seq.*, respectively, of the California Public Resources Code, (http://www.ciwmb.ca.gov).
139. Report of the Study Group on Economic Instruments in Environmental Policies, Japan 1999(?).
140. Requiring California Department of General Services to procure 25% of high grade writing paper with specified recycled content; requiring consumers of newsprint to purchase specified recycled content newsprint—California Integrated Solid Waste Management Act of 1989—Section 42200 *et seq.* and 42750, *et seq.*, respectively, of the California Public Resources Code; see also generally State Assistance for Recycling Markets, Section 12150 of the California Public Contracts Code, (http://www.ciwmb.ca.gov).
141. Rietbergen-McCracken, J., Hussein, A., "Economic Instruments for Environmental Management—A Worldwide Compendium of Case Studies," United Nations Environmental Program, Earthscan Publications, Ltd., London, UK, 2000, 208 p.
142. Rolfe, C., Nowland, L., Hillyer, A., "Economic Instruments and the Environment: Selected Legal Issues," West Coast Environmental Law Research Foundation and Environment Canada, Vancouver, B.C., Canada, 1993, (http://www.wcel.org/wcelpub/4994.html).
143. Schwed, K., "Recycling Laws and International ," (http://www.american.edu/ted/vxrecyc6.htm).
144. Sims, R., "Ames Lake Forest Saved Through Transfer of Development Rights Program," Kings County, 2002, (http://www.metrokc.gov/exec/news/2002/0724021.htm).
145. Speck, S., "A Database of Environmental Taxes and Charges: Greece 2000," Forum for the Future, 2000, ("http://europa.eu.int/comm/environment/enveco/env_database/greece2000.pdf" http://europa.eu.int/comm/environment/enveco/env_database/greece2000.pdf).
146. Speck, S., "A Database of Environmental Taxes and Charges: Ireland 2000," Forum for the Future, 2000, (http://europa.eu.int/comm/environment/enveco/env_database/ireland2000.pdf).
147. Speck, S., "A Database of Environmental Taxes and Charges: Portugal 2000," Forum for the Future, 2000, (http://europa.eu.int/comm/environment/enveco/env_database/portugal2000.pdf).
148. Speck, S., Ekins, P., "Recent Trends in the Application of Economic Instruments in EU Member States Plus Norway and Switzerland and an Overview of Economic Instruments in Central and Eastern Europe—Update of Database of Environmental Taxes and Charges," Forum for the Future, London, U.K., July 2000, 39 p., (http://europa.eu.int/comm/environment/enveco/env_database/delivery.pdf).
149. Svedin, U., "Integrated Product Policy—A Statement by the European Consultative Forum on the Environment and Sustainable Development," Brussels, June, 2000.
150. Transparency International Newsletter, Corporate News, information on the corruption and other offensive activities of various corporations, Transparency International, (http://www.transparency.org/newletters/99.2/corpnews.html).
151. Turmes, C., "WORKING DOCUMENT on Proposal for a Directive of the European Parliament and the Council Amending Directive 96/92/Ec Concerning Common Rules for the Internal Market in Electricity," Committee on Industry, External Trade, Research and Energy, European Parliament, 2001, (http://www.europarl.eu.int/meetdocs/committees/itre/20011218/456139EN.pdf).
152. Watson, R.T., Zinyowera, M.C., Moss, R.H., "Intergovernmental Panel on Climate Change: Technologies, Policies and Measures for Mitigating Climate Change," Chapter 8: Solid Waste and Wastewater, Chapter 9: Economic Instruments, IPCC Technical Paper I, November 1996, (http://www.gcrio.org/ipcc/techrepI/economic.html).
153. Zammit, C., "The Business Promotion Act: The Incentives Package," The Consul General of Malta, Victoria, Australia, 2002, (http://

w2.vu.edu.au/malta/econcomm/incentives.htm).

154. Zwick, S., "A Better Package Deal?", TIME Europe, May 2001, (http://www.time.com/time/europe/eu/magazine/0,9868,109664,00.html).