CHAPTER XVI. FINANCIAL ARRANGEMENTS FOR SOLID WASTE MANAGEMENT

A. Introduction

As previously indicated, in most developing countries local governments have the primary responsibility to provide solid waste management services. Local governments must rely on a variety of financial resources to fund the services. In most cases, different resources are used to finance capital investments than to finance operating and maintenance costs. Furthermore, a mixture of resources may be used for financing of the various components of a waste management system (i.e., collection, transfer, resource recovery, and final disposition).

In this chapter, the various methods of financing solid waste management services are discussed. Issues pertinent to economically developing countries, such as financing services to low-income or marginal areas, are presented. For low-income areas, reducing the need for government financing through encouragement of greater self-reliance and community participation also is discussed.

The option of privatising solid waste management services, as a means of obtaining capital and implementing user charges for the services, also is discussed. In addition, key issues associated with municipal strengthening, as well as costs associated with publicly-owned versus privatised service, are presented.

B. Financing capital investment costs

In this section, four methods of financing capital investments are discussed: reserves, bonds, loans/grants, and donations [9-11].

B1. RESERVES

In this particular case, the solid waste agency receives and saves a portion of current revenues for the sole purpose of financing capital investments. Reserves also are known as renewal funds and usually are used for investments in equipment replacement or to extend the service capacity of existing equipment [1].

B2. BONDS

Another way to obtain financing for capital investments is to raise funds from private investors through the issuance of bonds [1].

Public ownership of a solid waste management system or facility generally results in one of three financing methods: general obligation (GO) bonds, revenue bonds, or lease revenue bonds. In each option, the community issues tax-exempt debt and guarantees repayment of the debt with credit of either the community or the project's revenues combined with any other guarantee or insurance.

B2.1. General obligation bonds

This type of financing utilises the credit of the community as the credit pledge. Principal and interest payments for GO bonds can either be made from tax revenues or from the project's revenues.

B2.2. Revenue bonds

This type of bond is repaid from the revenues generated by the project or system. The bonds are secured by legal documents specifying the responsibilities of each participant, as well as the flow of funds. Revenue bonds were popular in the United States for financing waste-to-energy facilities, where revenues were obtained through tipping fees and sales of energy. If the bonds for a facility of this type are secured only by the project's revenues, they will command a higher interest rate.

B2.3. Lease revenue bonds

In this type of financing, a public entity or a specially formed non-profit corporation issues tax-exempt revenue bonds to finance a waste management facility. The facility is then leased to the municipality. Security for the bonds is provided by the lease between the two entities.

In situations when projected revenues for a particular project are too limited or the risks are too high, it may be in the government's best interest to provide financial incentives to the private sector to encourage participation in new business development. When the government provides financial incentives, it either provides financing directly to the private sector or sacrifices potential tax revenues from the private sector. Tax exempt bonds are one example of a government financial incentive that leads to a potential loss in tax revenues.

B3. LOANS/grants

Ideally, most capital investments should be financed through the use of reserves. Nevertheless, in order to finance major capital investments, municipalities may resort to borrowings. Borrowings derive from loans with commercial banks, international development banks, and central government banks.

In some countries, capital expenditure by local governments is controlled by the central government. Each year, the central government sets a limit on the total capital expenditure that can be made. Projects are submitted to the pertinent agency of the central government for approval. Once approved, the local government can borrow either from a public agency or from the money market.

Several international lending institutions have been involved in financing solid waste management investments in economically developing countries. Some of the most active institutions include The World Bank, the Asian Development Bank (ADB), and the Inter-American Development Bank (IDB). The financings have covered replacement and expansion of the solid waste collection fleets, construction of transfer stations and purchase of transfer trucks, design and construction of sanitary landfills and purchase of landfill equipment, development of composting facilities, and others. The majority of the financings of solid waste management projects have been included as part of development bank loans for large urban development projects.

Borrowings for major solid waste management investments may be financed through the project or through general obligation financing. In project financing, the financial viability of the project is compared with the revenues that the project is expected to generate. In general obligation financing, the credit of the local government secures the loan. For both types of financing, if future revenues are in doubt, it may be necessary for the central government to secure the loan. Most loans for solid waste investments are project financing.

It is possible to finance some costs that would commonly be considered recurrent operating costs within arrangements to finance capital investments. For instance, capital investment in solid waste equipment could include the acquisition of a large supply of parts that are used frequently. Loans from development banks commonly make allowances for purchasing spare parts within the equipment procurement that they finance. This is part of a policy to ensure that the equipment financed can be successfully utilised to provide service and, thus, improve the revenue generation of the service entity.

In most developing countries, the central government will more than likely continue to be the principal source of funding for major projects in solid waste management.

B4. DONATIONS

Municipalities in developing countries often have access to a variety of organisations that can donate funds, human resources, or equipment for environmental protection and solid waste management. The organisations can be either national or international. Some of them are willing to assist in solving a specific problem without any conditions, while others impose rather stringent and sometimes costly conditions. This option is purposely included as one of the last options for financing solid waste services because the authors have observed several ill-advised "donations" in which the donations have been encumbered with conditions such that they eventually become costly investments to the community. One such example is the installation of an incinerator for combusting residential wastes in a community located in a tropical country, where the wastes would have a very high concentration of wet organic matter. Another one would be the donation of a few used, compacting collection vehicles to a city that is located in hilly terrain and that has narrow, unpaved roads. The cost of operating and maintaining the "free" vehicle is oftentimes several times higher than operating a simple animal-drawn vehicle. It is important to emphasise, however, that not all donations are failures. There are countless positive experiences throughout the world. Unfortunately, the recipients of the donations must be cautioned to carefully analyse the advantages and disadvantages of accepting a particular piece of equipment or system before it is put into use in the community.

C. Financing operating and maintenance costs

C1. FINANCING methods

In developing countries, operating and maintenance (O&M) costs, also known as recurrent costs, can be financed by means of several methods. A brief discussion of each one of these methods is presented in the following section [9-11].

C1.1. General revenues

Local governments obtain their revenues from a variety of sources such as property taxes, fines, and license fees. Local governments typically use their general revenues to finance costs associated with labour, consumables, and spare parts (O&M). Since the revenues in most municipalities in developing countries often are insufficient to cover O&M costs for solid waste services, grants or subsidies from the central government are used to supplement local revenues. In some countries, municipalities receive a fixed percentage (on the order of 10%) of the country's general budget to complement their general revenue.

C1.2. Grants from central government

Theoretically, grants from the central government would only be justifiable for those cities that have national importance as centres of government, industry, and commerce (such as the capital).

The grants and subsidies would be justifiable as benefiting national economic growth. However, since central governments usually limit the ability of local governments to generate their own revenues, subsidies compensate for the lack of decentralisation.

C1.3. Sources of revenue

Unfortunately, a large number of local governments in developing countries have extremely limited sources of revenue. The amount of residential waste generated in developing countries is about one-third to one-half of that generated in industrialised countries. However, since their taxable income is so low, either a lower standard of service or a less capital-intensive system must be considered.

Ideally, a solid waste service organisation should be accountable for all costs, and the tax or fee paid should reflect the actual costs for the service. Property taxes are not suitable for financing solid waste services, unless it is clearly stipulated that a certain portion of the tax must be used to cover the costs of solid waste service. It is preferable to implement user charges, because these charges raise public awareness about the costs associated with providing the service. User charges have the tendency to make the service agency accountable. Furthermore, if the charge is related to the quantity of waste discarded, the charge may serve as an incentive for waste prevention.

One of the main problems associated with the implementation of user charges is that not everyone is willing or able to pay a user charge for solid waste service. Well designed surveys to determine both the willingness and capacity to pay should be carried out prior to the establishment of tariffs. Generally, the collection of user charges for waste services is extremely low. Some cities have tried to solve the problem of willingness to pay by attaching the user charge to the billing for a service for which residents are more willing to pay. For example, in the past in Lima, Peru, the user charge for solid waste was included with the electricity bill. In other developing countries, residents receive a single bill for water, wastewater, solid waste, and other services such as television and security, if applicable. Combined billing of services allows for reduced costs associated with the billing process, and leads to a high collection rate of the user charges. Furthermore, the addition of solid waste service charges has not led to a discernible reduction in the collection of user charges for electricity or water. In setting the tariff, consideration should be given to making allowances for cross subsidies. Large commercial establishments and high-income residential areas (which typically demand a high quality of service) would be charged a higher tariff than low-income areas.

In a large number of municipalities, the revenues that are collected for waste services generally are deposited into a general account. Once in that account, the funds are often utilised for a number of purposes other than waste management.

C2. COSTS of solid waste service

In order to generate sufficient revenues to cover the costs of solid waste service, a jurisdiction should have a thorough understanding of the actual costs associated with providing the service. Unfortunately, very rarely are the costs fully known. Budgets for departments of local government are based on projections from previous budgets and/or the need to pay salaries and purchase supplies. In order to determine the true costs for solid waste management, the costs incurred from several departments must be consolidated.

C3. RESPONSIBILITY for service delivery

Since activities associated with the delivery of solid waste services generally are decentralised in economically developing nations, it typically is extremely difficult to determine the full costs of the service. Accountability of, and responsibility for, service provision is also difficult to determine in a decentralised system. One of the best methods to resolve accountability is to establish a single entity responsible for all aspects of solid waste management. In order to obtain revenues, it is essential that this entity have the following: 1) equal status with other agencies in the local government that may be competing for a portion of the revenues, and 2) capability to assess and justify financial needs.

Assigning responsibility might be partially addressed by upgrading the status of a solid waste office, which is typically set up within another department having different responsibilities (e.g., Public Health Department, Public Works Department). The department chief would then have the opportunity to request some of the available revenues, as well as the professional staff necessary, to prepare the financial justification for budgetary needs.

Placing all solid waste activities within an independent organisation would assure accountability for the service. These types of organisations usually are autonomous. Generally, political leaders and members of the private sector are appointed to the Board of Directors. These organisations receive grants from the state and local governments. They also generate their own revenues through special charges and fines. Since these organisations are financially responsible and capable of generating their own revenues, it is considerably easier for lending organisations to work with them in obtaining financing and determining the means for cost recovery.

A study conducted in Latin America by The World Bank evaluated 16 semi-private solid waste enterprises. Although the enterprises were relatively accountable, the results of the study indicated that they were not financially independent. All entities received some type of government subsidy and most of them obtained only a small fraction of their revenue from service-related taxes or user charges [3,4].

D. Financing waste management services for marginal areas

In most economically developing countries, the urban poor usually live in marginal areas and squatter settlements. These areas are occupied illegally, and the settlers generally do not pay taxes to local jurisdictions.

In most cases, the marginal areas are not provided with water supply, electricity, wastewater collection, or solid waste services. The shortage of technical and financial resources is primarily responsible for the lack of basic services to these areas. As a result, those responsible for the management of solid wastes have the tendency to concentrate their efforts in high- and middle-income areas of the cities.

It is typically assumed that the residents of marginal areas are not willing to pay for solid waste services. However, the results of work conducted by the authors indicate that this may not necessarily be the case. In some countries in Latin America, the waste generated in low-income areas is collected by individuals outside of the formal collection system. The fees charged by these individuals are comparable to those charged by the formal sector. The level of user charge that has emerged throughout the urban poor areas in Latin America is on the order of US$3 to US$7/ dwelling/month.

D1. SERVICE alternatives

The lack of financial resources in economically developing countries does not allow for the provision of basic services to all segments of the population. In this section, alternatives are developed for providing solid waste services in low-income areas. Inasmuch as financial resources are limited, innovative solutions must be developed that take into consideration appropriate levels of service for different types of neighbourhoods and local conditions, as well as other factors.

D1.1. Public participation

A very practical and efficient alternative for providing solid waste services in marginal areas is to encourage public participation. In this particular case, the residents are requested to volunteer some of their time and effort and, thus, keep the outlay of financial resources to an affordable level.

Public participation can be accomplished by requesting that the residents of marginal areas transport their residues either to a conventional collection vehicle provided by the municipality or to a communal container located in a strategic location. In the first option, arrival of the collection vehicle is announced by means of a bell or a loud horn. In the communal container option, different types and sizes of containers can be used. The size of the container can range from half a drum (i.e., a drum in which the top half is cut off), to a whole drum (about 120 L), or to ≥ 1 m^3 containers. In any case, it is important that the containers be emptied by the collector at a fixed frequency and that they be located at convenient distances (i.e., generally not more that 100 m apart). In both alternatives, savings are realised through the reduction in the number of personnel in the collection vehicle.

Another option that has been used in marginal areas involves rigorous public participation initiatives. In this type of alternative, residents are requested to participate in workshops and public meetings in which they are instructed on the benefits of public health and solid waste management. In addition, residents are introduced to recycling processes involving the separation of organic and inorganic matter. The residents are then requested to treat their organic wastes onsite, and to segregate and turn in their dry recyclable materials to a local collection crew or to a neighbourhood recycling depot. The recyclable materials are sold, and the revenues from the sale of the materials are used to pay for the collection and processing costs.

In most cases, these projects have been funded by international development agencies, with the technical assistance of non-governmental organisations (NGOs). Experience thus far indicates that it is important that the technical assistance to the community be continued and maintained over a long period of time to assure a high degree of success.

D1.2. Micro-enterprises

Another viable option to providing collection services in marginal areas involves the establishment of micro-enterprises. In this approach, the full costs of providing the collection service to the particular area are borne by the residents of the area. As such, a small enterprise is established in which residents of the area are requested to participate. The members of the enterprise are trained in their different duties (from collection to basic bookkeeping). In order to keep the investment and operating costs to an affordable level, the enterprise provides the house-to-house service, while the municipality is requested to assist with the transportation of the wastes to the disposal site. Options of this type have been established in Latin American countries, with the assistance of NGOs. Experience thus far indicates that this type of organisation can be established successfully. The success of the enterprise depends upon a

number of factors, including: financial arrangements, logistics and degree of cooperation obtained from the municipal government, level and type of technical assistance, and degree of dedication of the members of the micro-enterprise. The key issues associated with the micro-enterprise include establishment of tariffs; punctuality of payment (either by the municipality or by the householder); and level, type, and length of qualified technical assistance given to the staff of the enterprise.

E. The role of the private sector

The provision of solid waste management services is a very costly and difficult undertaking for many municipalities throughout the world. The level of cost and degree of difficulty associated with the service provide an opportunity for participation of the private sector. In general, the private sector potentially can play two key roles in the field of solid waste management. One important role is to increase the efficiency of the service and, thus, reduce the cost in existing waste management systems. The other key role for the private sector is to provide much needed sources of funds for capital investments. As previously indicated, solid waste management systems in economically developing countries tend to be extremely inefficient, providing relatively low coverage at a high cost, and oftentimes becoming an "employment agency" to a large number of unneeded labourers.

One of the potential benefits of privatisation of the service is the ability to recover the costs of service through the implementation of user charges. The implementation of user charges, or the increase to existing charges, generally is an extremely difficult political decision that can best be managed by allowing the private sector to impose them [5,7,8].

Privatisation, however, is not the total solution to the successful provision of solid waste management services. First of all, privatising some aspect of the solid waste service delivery or the entire system does not reduce or eliminate the responsibility of local government for the service. Furthermore, privatisation of services should not be interpreted as weakening of the local government. On the contrary, in order for local government to effectively privatise some of its services, certain areas of the government institutions must be strengthened. Only a local government institution having competent and qualified professional staff will be able to develop, negotiate, manage, monitor, and enforce a contract with a private entity [2].

The types of privatisation most commonly used in solid waste management include: contracting, franchise, open competition, and vendor/operator equity investment [7].

E1. CONTRACTING

In this case, a private firm, by means of turnkey contracting, may design, build, own, and operate a solid waste facility such as a transfer station, a resource recovery plant, or a sanitary landfill. In the 1980s, turnkey contracts became a popular means of financing resource recovery projects in the United States. Private ownership was encouraged through financial incentives established by the central and state governments. Some of the financial incentives included tax benefits and opportunities for accelerated depreciation [1]. A substantial portion of the waste-to-energy plants in the United States is privately owned.

Perhaps one of the better areas for the private sector to enter the waste management field is in the area of waste collection under contract with the local government. As a result, it is feasible for local firms with modest financial resources to enter into the business of solid waste collection. A study of privatisation in Latin America indicated that most of the firms were of a small to medium size, demonstrating that there were virtually no barriers to entry [3]. Additionally, as previously pointed out, the demand for collection service in many low-income areas in

economically developing countries provides the opportunity for very small entities (micro-enterprises) to provide the service [6].

Privatisation is an appropriate alternative for providing much needed solid waste services in many countries. However, the service must be properly described, performance indicators established, costs delineated, an equitable contract developed, and monitoring functions well defined in order to receive the most benefit from the service. Therefore, contracting seems to be better suited for isolated activities (which can be evaluated easily) within the solid waste system, such as the operation of a landfill. In Buenos Aires, Argentina, private firms provide waste collection services and operate transfer stations and sanitary landfills under contract with CEAMSE, the government entity responsible for solid waste management. In Mexico City, a private entity operates one of the major landfills.

In the event that sufficient funds are not available for the acquisition of equipment or it is difficult to borrow the funds, it is possible to contract for provision of the equipment. For instance, some or all of the solid waste collection fleet can be leased from private firms. The firms can provide the vehicles only or the vehicles with the drivers, fuel, and even maintenance. One of the major disadvantages in this option is that the vehicles available for lease in developing countries often are not well suited for waste collection (particularly residential waste), since the majority of the equipment is used in the construction business. Since collection is one of the more expensive phases of the waste management process, the option of leasing vehicles should be carefully considered before it is implemented [6].

Another possibility for privatisation of collection services is to adopt a system that would consist of the following elements and functional relationships. The municipality would purchase appropriately designed collection trucks. The vehicles would then be leased to qualified contractors, who would be responsible for the operation and maintenance of the vehicles. In order to avoid the potential of poor operation and inadequate maintenance, the municipality can institute a rigorous monitoring program and provide the maintenance. On the other hand, operation and maintenance can be left up to the contractors, with the understanding that after a predetermined number of years the vehicles would be owned by the contractors.

If a municipality is considering privatisation of the collection system, it may be advisable to privatise a portion of the city and maintain public services in another. Under this system, the collection areas should be selected carefully so that they are comparable. The mixture of private and public services results in having both methods accountable to the users and, thus, encourages competition. Consequently, the public entity is motivated to provide efficient service, and the private organisation understands that efficiency and tariffs can be compared, as well as the fact that the municipality would still be able to take over the system if the service provided by the contractor is not satisfactory.

E2. FRANCHISE

In this option, the law empowers a municipality with the authority to give to a private entity an exclusive franchise, or right, to provide service to customers in various zones under the municipality's jurisdiction. In return for an exclusive franchise granted by the municipality, the private firm pays a franchise fee to the municipality. Under a franchise system, the firm is responsible for providing the service and can charge its customers to recover the cost of the service. In this situation, the municipality or local government maintains responsibility for supervising the performance of the private firms. Additionally, the municipality must maintain some degree of oversight and/or set limits on the type and level of tariffs.

E3. OPEN Competition

In economically developing countries, a municipality typically uses open competition in the private sector to secure maintenance and repair services for equipment used in the solid waste management system. In some cases, minor repairs are performed by maintenance personnel employed by the government. However, for major repairs of waste collection vehicles and other heavy equipment, the common practice is to request quotations from private garages and to grant the repair work to the lowest qualified bidder. Depending upon the size of the service area, it may be advisable to contract as well for the performance of minor repairs in order to economise on time and distance travelled.

Private collection through open competition is another viable option to municipalities in developing countries. This type of service provision is especially applicable in large urban areas where private collection firms are established. One of the advantages of this option is that through a well designed procurement process and a sound, as well as transparent, evaluation process, a municipality can select the most appropriate conditions for its particular situation and secure the lowest price. On the other hand, this alternative presents the possibility that an established firm may lose a contract and, thus, its investment and experience to one with little experience.

The alternative of open competition has been used several times by the City of San Jose, California in the implementation of its integrated mixed waste collection and recycling program.

E4. VENDOR/operator equity investment

This is an alternative for the private sector (the vendor or operator of a facility or system) to provide equity investment based on potential financial benefits (i.e., tax benefits). In developing countries, the equity investment varies from about 10% to 80%, or even 100%, of the project cost. The remainder of the funds generally is obtained by means of institutional loans. In some cases, the municipality guarantees a certain payment for the service (i.e., cost/Mg), and requires that the ownership of the particular process or system revert to the municipality after a certain time period.

F. Financing considerations and requirements

F1. SELECTION of financing method

In general, selection of the most appropriate means of financing a particular solid waste management project should be based on considerations of degree of risk or benefit and on the most cost-effective option to the rate payers. Essentially, a municipality should address the following three key issues associated with financing: 1) perform a thorough analysis to determine the financing method that results in the lowest tipping fee to the users, 2) identify the potential liabilities related to each financing alternative, and 3) determine the potential advantages and disadvantages associated with each alternative.

F2. VIABILITY of the project

At the risk of stating the obvious, one of the more basic requirements for financing, regardless of the type of method to be selected, is that the proposed solid waste management program be financially and economically viable. Viability can be thoroughly evaluated by developing and implementing a computer model and continually updating the model with current information. A good model allows the evaluation of several options or scenarios, and the impact of changes on the tipping fee. In addition to the development of a model, there are a few other key requirements that should be carefully explored and analysed before a final decision is made.

F3. RELIABILITY of waste supply

A reliable quantity of waste is a critical component of a solid waste project. The supply of waste should be available for the term of financing. A typical agreement involves a "put-or-pay" contract, signed by the municipality or solid waste authority, essentially guaranteeing delivery of a minimum amount of waste at a certain tipping fee. In the event that the municipality is unable to deliver the agreed minimum quantity, the municipality still has to pay the tipping fee for that minimum delivery.

F4. SERVICE agreement

Contracts should be developed and executed that clearly define the terms of the agreement. The various responsibilities of the parties involved should be delineated, such as acquisition of sites, permits, startup, operation, maintenance, and the terms under which payment for services will be made.

F5. SALES of materials and/or energy

Contracts should be in place with the entities that are going to purchase the resources that will be recovered from the waste stream. Ideally, these agreements would be made on a "take-and-pay" basis. A take-and-pay agreement simply means that the buyer must accept agreed-upon quantities of materials or energy, and pay for the resources regardless of use. This is particularly important when energy is produced. In the event that materials are recovered from the waste, then a minimum price per unit weight should be negotiated and included in the contract. The quality, or specifications, of the recovered resources also should be described in the contract, as well as a description of the method for adjusting the purchase price if the specifications are not met.

F6. AVAILABILITY of final disposal site

In the event that the project that is to be financed involves some type of resource recovery process, then provisions must be made to dispose of the residues. The residues would take the form of reject materials from a materials recovery process, or of combustion ash and waste that cannot be processed from a thermal treatment process. In addition, arrangements must be made to bypass and landfill the entire waste stream in the event of temporary shutdowns due to breakdowns, strikes, or other reasons.

F7. LEGAL authority

A legal authority should be clearly identified and established before financing is finalised. The legal authority acts as the responsible public agency for the project.

F8. PERMITS

All required permits should be obtained for the various solid waste facilities to be built and operated under the contract. Permits should be obtained from local, state, and national agencies, as appropriate.

F9. AGREEMENTS

Depending on the type of solid waste management project, some or all of the following types of agreements should be in place before the final financing process begins: waste supply agreements, construction contracts, operating agreements, end product purchase agreements, and financing agreements. Construction contracts should cover all aspects of construction, including:

timing and performance levels, technology to be used, and others. The contractor should have sufficient financial capabilities to guarantee the required performance of the agreements. Operating agreements should identify the operator of the facility, performance and operating conditions, and terms of payment. The financing agreements should specify items such as the requirements for reserve capital, debt coverage requirements, and terms of repayment.

F10. FINANCING process

The entity responsible for the financing must review in detail all aspects of the project and make sure that all requirements have been met. The review basically falls into three general categories: 1) evaluate the project's ability to secure financing, 2) develop and structure the financing, and 3) market the securities to finance the solid waste facility (if applicable).

F11. OWNERSHIP

Before final financing of a solid waste management is reached, the municipality must decide whether final ownership will rest in the public sector or in the private sector. The decision regarding ownership should consider the following items: expediency, risk assumption and allocation, control of the project, costs, and tax implications (if applicable).

G. The impact of resource recovery on financing

Resource recovery (e.g., recycling, composting), if properly conceived and implemented, can reduce the financial impact of waste collection and disposal services. For example, the separation of recyclable materials (such as paper, glass, metals, and plastics) at the source of generation leads to a reduction in the quantities of waste, which the local government would have to transport and dispose at a landfill. In economically developing countries, the mixed municipal waste stream typically contains on the order of 20% to 30% (by weight) of potentially recyclable inorganic materials. As the economic status of a particular country improves, consumption patterns change and an increase can be expected in the percentage of recyclable materials in the waste. Thus, savings in disposal costs may be available in the future if additional quantities of recyclable materials are recovered and marketed. In addition, the segregation and processing of the organic matter in the waste can make a sizeable contribution to the reduction of quantities requiring ultimate disposal, since organic matter typically constitutes 50% to 60% of the residential waste stream.

The recycling program must be properly planned and implemented; otherwise, the program may lead to substantial increases in the collection and processing costs (e.g., having to collect the source-separated materials by means of a vehicle other than a refuse collection truck). Perhaps one of the best approaches to encourage source separation is to provide some type of incentive to the community. One of the simplest and easiest methods of community-based recycling is the implementation of the buy-back centre. In this system, startup capital is provided to enable the centre to purchase ("buy back") recyclable materials from the generators. Generators are responsible for transporting the materials to the buy-back centre and the materials must meet certain minimum specifications. This approach works well if the generator does not have to travel long distances to sell the recyclable materials. The centre must be equipped with storage bins, scales, processing equipment to meet buyers' specifications and to reduce transport costs (e.g., baling equipment), and accounting offices.

Another approach to community recycling is to request and promote segregation of recyclables at the source of generation, followed by transport of the recyclable materials to a community-based facility for processing and marketing. To be cost effective, the collection and processing costs associated with the recycling program should be less than the revenue obtained through the sale

of the materials, or the net cost of collection and processing should be less than the cost of collection and disposal if the materials were disposed instead of recycled. The criterion for cost effectiveness chosen by a community depends on a number of factors, including the environmental benefit of recycling, which is difficult to quantify economically. These and other approaches to resource recovery and recycling have been presented in other chapters.

Regardless of strategy or system, marketing of the recyclable materials is fundamental to the success of any type of recycling program. Recycling programs should not be instituted without having contracts or agreements signed for the purchase of the recyclable materials. The contracts should stipulate some key items, such as: specifications for the materials, minimum quantities accepted, physical form (baled, shredded, etc.), and floor prices. A municipality can also undertake and initiate market development programs in order to seek and establish new local and cost-efficient uses for the recyclable materials. On a regional scale, central governments can encourage the development of markets for recyclable materials from the waste by limiting subsidies for virgin materials that compete against recyclable materials for particular uses, such as any subsidies favouring forest products over wastepaper as a feedstock for pulp and paper manufacturers.

H. References

1. Hilgendorff, C.C., "Emerging Trends in Solid Waste Finance", *Solid Waste & Power*, 3(2), April 1989.

2. Seader, D., "Privatization Moves to the Forefront", *Solid Waste & Power*, 3(2), April 1989.

3. Bartone, C.R., L. Leite, T. Triche, and R. Schertenleib, "Private Sector Participation in Municipal Solid Waste Service: Experiences in Latin America", *Waste Management & Research*, 9(6), December 1991.

4. Bartone, C.R., "The Role of the Private Sector in Developing Countries: Keys to Success", *Waste Management: The Role of the Private Sector*, ISWA Conference, Singapore, Malaysia, September 1995.

5. Scarlett, L., "Solid Waste Management Privatization: A Survey of Success Factors in the United States", *Waste Management: The Role of the Private Sector*, ISWA Conference, Singapore, Malaysia, September 1995.

6. Diaz, L.F. and J.M. Ortellado, "Privatization of Solid Waste Services in Latin America", *Waste Management: The Role of the Private Sector*, ISWA Conference, Singapore, Malaysia, September 1995.

7. Alegre, M.C., *Privatisation in Solid Waste Management*, Master Thesis, Loughborough University of Technology, England, September 1994.

8. Donnelly, P. and C. Rines, "The Effect of Existing Law on the Financing of Municipally Sponsored Systems for Converting Waste to Energy", Symposium on Energy from Biomass and Wastes IV, Argonne National Laboratory, Argonne, Illinois, USA, 1980.

9. Resource Planning Associates, *Financial Methods for Solid Waste Facilities*, U.S. Environmental Protection Agency, Office of Solid Waste Management Programs, Washington, DC, USA, 1974.

10. Bolczak, R. and R.E. Zier, “Financing Options and Alternatives”, *Solid Wastes Management*, September 1982.

11. Dawson, R.A., “Facility Financing Options”, *Solid Wastes Management*, April 1982.