Executive Summary of

GUIDEBOOK

FOR THE APPLICATION OF
WASTE TO ENERGY TECHNOLOGIES
IN LATIN AMERICA AND THE CARIBBEAN

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EXECUTIVE SUMMARY

Introduction and Scope

The economic development and growth of urban population in the Latin America and the Caribbean (LAC) region have resulted in the generation of an increasing amount of municipal solid waste (MSW) that is surpassing the existing capacity of sanitary landfills. This situation has led governments to evaluate alternative options, such as waste reduction, recycling, and waste-to-energy (WTE), in order to divert the waste stream from landfills.

WTE is a thermal treatment technology with energy recovery, and has become one of the preferred choices in most northern European Countries, Japan, in several cities in the US, and increasingly in China. However, the high investment and operational costs of this technology, and the lack of information and communication with the population regarding the environmental impacts of WTE, have precluded its development in LAC.

The objective of this document is to provide a Technical Guidance Note, aimed at providing basic technological, financial, and environmental information about WTE facilities. It is expected that this Guidance Note will enable policymakers and SWM services managers in LAC to make informed decisions about the feasibility of this treatment option for any specific case. This Guidebook is divided in two parts: Chapters 1 to 6 describe the general aspects of WTE technologies and project development; chapters 7 to 10 present several cases studies of WTE application in the LAC region.

Technical Aspects of WTE

There are several approaches and technologies to enhance solid waste treatment practices, which range from reducing the generation of waste by better design of products and packaging, to recycling usable materials, composting green wastes, and combustion with energy recovery. Globally, over 80% of the total urban post-recycling MSW is landfilled (about 1 billion tons per year), and only 20% of this waste is disposed in sanitary landfills.

Following the Hierarchy of Waste Management, several of the most developed nations have established the goal of reducing solid waste landfilling, by increasing waste prevention, recycling and energy recovery rates as feasible options for waste management.

Chapter 1 of the Guidebook examines the factors that determine the chemical energy stored in the various constituents of MSW. Plastics and other petrochemicals consist mostly of carbon and hydrogen, and therefore, have the highest energy content. They are followed by biogenic materials, such as paper, food, and green wastes that also consist of carbon and hydrogen, but also contain about 50% oxygen. These are followed by metals and other inorganic compounds that have no usable energy. The moisture content of the MSW absorbs heat during combustion, and therefore decreases its heating value.

Chapter 2 describes the combustion technologies that have been developed for recovering energy from MSW. Broadly, they involve the combustion of "as-received MSW" on a moving grate ("grate combustion"), shredding of MSW and combustion on a moving grate or in a fluidized bed, and the mechanical-biological treatment of MSW.

Chapter 3 describes processes that use partial combustion of the MSW to produce a synthetic gas ("gasification"), or heat petrochemical wastes in the absence of oxygen to produce a liquid fuel ("pyrolysis").

Chapter 4 examines the current state of the global WTE industry, including the number and types of plants using the various WTE technologies. About 80% of the world's WTE capacity is based on technologies of "grate combustion" and this includes the WTE plants that has been built worldwide in the past decade. This is mainly because of the simplicity of operation, high plant availability (e.g., for the number of hours at full operation per year -some providers of grate combustion furnaces guarantee over 8,000 hours/year), and the relatively low personnel requirements.

Environmental and Economic Aspects of WTE

Chapter 5 concentrates on the dominant WTE technology, i.e. combustion on a moving grate. The chapter provides detailed information on the operation of a WTE plant, the typical material and energy balance, the energy recovered per ton of MSW, the environmental controls (air pollution control systems used and the resulting emissions), and the management of the bottom ash and fly ash produced during the combustion process.

Chapter 5 also discusses the projected capital, operating costs, revenues and the land requirements for such plants. Additionally, it describes how to implement WTE in a municipality, including: the procedure to be followed for inviting providers of WTE technologies to bid on a new project, the stakeholders who are involved in this process, and other information to guide officials who are considering to build a new WTE facility.

Chapter 6 presents the conclusions drawn from developing this Guidebook.

Case Studies

On the basis of some hypothetical assumptions, Chapters 7 to 9 evaluate the feasibility of some specific WTE projects in three LAC cities: Valparaiso (Chile), Toluca (Mexico) and Buenos Aires (Argentina). The cities have been chosen taking into account: (i) economies of scale (considering that the cost per ton of thermal treatment decreases appreciably with plant size), and (ii) the economic capacity of these cities (considering the high investment and operational costs of this type of technology). The technology selected for the three cases is “grate combustion” because it is the most widely proven WTE technology.

The case studies show what information must be developed in order to build such a plant, including quality and quantity of MSW, the current and projected status of the MSW management system; the projected capital and operating costs, the projected sources of revenue, and calculations of the net present value (NPV) and internal rate of return (IRR).

The main conclusion from these case studies is that considering the gate fees for landfilling in Latin America, usually the WTE alternative will only be economically feasible if government support is provided. For example, for the WTE project in Chile to break-even after 20 years operation and at a 5% IRR, the required gate fee would be of 38 US$/tn. Additionally, it is concluded that to have an affordable gate fee for the WTE project, it is necessary to have a very high plant availability. This is connected to the quality and quantity of the MSW provided to the plant, i.e. the WTE solution must consider the collection and transportation rates and the robustness of the overall solid waste management system.

Chapter 10 examines the application of WTE in island settings, by describing three existing plants in the Caribbean islands and the North Atlantic.

Decision Making Process

This Technical Note proposes that national governments place the sustainable waste management high up in their essential infrastructure projects priority list, similarly to what has been done in the past with potable water, electricity and wastewater treatment infrastructure. Specifically for the WTE alternative, a short and long term analysis of its impact on the solid waste management system should consider costs and financial analysis, the quality and quantity of MSW needed to guarantee the continuous operation of the project, the addition of a renewable energy source, the amount of land conserved due to less waste being landfilled, and the environmental and greenhouse gas benefits of WTE, in comparison to other treatment and disposal alternatives.

In the last two decades, the WTE industry in Europe, North America, and Asia has developed technologies capable of reaching acceptable emissions standards, representing feasible sources of thermoelectric energy. By far, the dominant WTE technology, practiced in over six hundred plants in over forty nations, is the “grate combustion” of “as-received MSW” with production of electricity and heat. However, alternative processes, such as circulating fluidized bed combustion, are being developed and it is possible that one or more of them may result in lower capital costs per ton of MSW processed, than grate combustion of as received MSW. Therefore, requests for proposals to build a WTE should be open to all technologies, provided they meet the required technical and environmental criteria.

The contractual arrangement for the construction of a WTE project must include the ironclad commitment of the general contractor that the plant will operate at the specified plant availability (hours per year at full capacity), deliver to the grid the specified rate of electricity per ton of MSW processed, and meet continuously the specified environmental standards. The host municipality is also contractually committed to collect and provide to the WTE plant the specified daily and yearly tonnage of MSW and that this material is within the specified range of calorific values.

Despite being an important treatment option, WTE usually is not economically feasible without some government support. However, as cities in LAC move from open dumps to sanitary landfills, the true cost of landfilling will be increased to the point that the WTE solution could be economically competitive, because of its energy recovery, much lower land requirement, and other potential advantages. Moreover, the economic comparisons developed in this Guidebook are based on a 20-year life of the WTE plant, while some of the existing WTE facilities have already reached their fortieth year and will continue operating in the foreseeable future. Therefore, investing in a WTE plant represents a patrimony by the municipality to future generations.

Hierarchy figure here

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