SOLID WASTE RECYCLING IN FLORIDA

Authors:
Dr. Faustino G. Prado
Mr. Faustino L. Prado, P.E.

PRADO & ASSOCIATES, INC.,
TAMPA & LAKELAND, FLORIDA

Presented at the Annual Meeting of the AIChE Florida Sections

Clearwater, Florida

May, 1991

OUTLINE

Abstract

What is Municipal Solid Waste

Solid waste disposal methods:
- Landfilling
- Sorting and recycling
- Composting
- Waste-to-Energy:
  - Mass burning
  - Refuse-Derived-Fuel (RDF)

The Environmental impact of Waste-to-Energy plants

The MSW picture in Florida today

Slides:

Alternatives
Flow diagram of typical mass burning plant
Flow diagram of typical RDF plant
WTE plants currently in operation in Florida
Pictures of existing facilities

ABSTRACT

Modern society generates large quantities of garbage and trash, collectively called municipal solid waste. Traditionally, most of it has been landfilled. Most landfills in the US are nearing full capacity. Those in Florida threaten the aquifer, the source of drinking water for many communities. In Europe, where real estate prices are much higher, composting, recycling and incineration have been practiced for many years.

In Florida several solid waste incineration plants have been built recently. At the present time, there are close to a dozen plants which not only burn the solid waste, but co-generate electricity as well. A composting plant started up in central Florida recently.

This paper will examine the solid waste problem in general and offer some technical and economic solutions. Examples of current waste-to-energy facilities will be shown.

WHAT IS MUNICIPAL SOLID WASTE?

Municipal Solid Waste (MSW) is a general term used to designate solid waste generated by urban areas in the form of garbage or trash. It generally excludes specialized waste such as biologically active materials generated by hospitals, toxic or hazardous waste generated by industry, and agricultural waste which is usually biodegradable.

Municipal solid waste is typically produced by households in the form of garbage and trash. Garbage contains putrefactive materials, newsprint, plastic containers, and glass bottles. Trash generally consists of yard waste. Waste generated by small commercial enterprises such as restaurants also falls under the designation of municipal solid waste.

SOLID WASTE DISPOSAL METHODS

Landfilling

In the United States in general and in Florida in particular, municipal solid waste has been traditionally disposed of by landfilling. In recent years, the cost of landfilling has increased tremendously, as existing landfills become full and new ones have to be acquired and developed. It is estimated that construction costs at landfill sites range from $75,000 to $400,000 per acre. In addition, in many instances, land suitable for new landfills is simply not available. At this time it costs approximately $68 a ton to put waste in the landfill of the city of Tampa.

In addition to the diminishing availability of land, traditional landfills have been suspected of contaminating the adjacent aquifers as well as creating a nuisance in their vicinity. New regulations now require that landfills include an impermeable liner to protect the water table. Venting may also be needed to exhaust methane gas formed during the biodegradation of the waste. All of this adds to the cost of creating a new landfill, assuming that the land can be procured.

Fifteen years ago, Florida had 500 active landfills. In 1990, only 170 operated under state permits. Some of the closed landfills were fill. Others were closed because they did not meet environmental standards.

Sorting and Recycling

A common sight in many European cities are the colorful collection bins located in convenient locations. The idea is to collect as much as possible the recyclable components of municipal solid waste. These include newspapers, glass, tin and aluminum cans, and plastic. Since these materials constitute a large portion of municipal solid waste, a successful collection program will result in a substantial reduction in the waste collected.

The ideal sorting and recycling program will involve the voluntary collection described above. This implies a large measure of public education and discipline that has been traditional in western Europe. Some pessimists have argued that a completely voluntary collection program will not work in the United States.

In lieu of voluntary collection and sorting, there is the alternative of either manual or mechanized sorting at a central facility. This, of course, adds to the cost of the program.

Any sorting program will leave the putrefactive materials to be dealt with. They must be either landfilled, composted, or sent to waste-to-energy facilities.

A voluntary program was put into effect in Pinellas county recently. The pilot program grinds up yard waste and turns it into free mulch for the public. This program shrank the county's trash stream by 13,771 tons in the year 1990, reducing the trash going to the county waste-to energy plant by 2 percent. Thus far the program has met public approval. So, there is hope.

In Florida recycling is being boosted by the Solid Waste Management Act, which requires that by newspaper, aluminum cans, glass and plastic bottles be separated from the garbage stream. More specifically, the law requires that 30 percent of the municipal solid waste in each county be recycled by 1994. The balance will be disposed of evenly between landfills and waste-to-energy plants. In 1988, DER estimated that 560,000 tons of materials were separated from garbage. By May 1989, newsprint had become the most commonly recycled item.

Composting

Composting consists of the aerobic or anaerobic digestion of the biodegradable component of municipal solid waste. In order to optimize the process, it is necessary to remove the non-compostable materials such as metals, glass and plastics. Since this "front end" operation is complex and costly, composting is not as economic as many people believe.

Aerobic digestion proceeds faster and is generally more common, although some systems feature both methods of digestion in series. The digestion takes place after much of the non-biodegradable components of the waste have been removed. Digestion can be performed in closed vessels, in open piles called windrows, or in both.

Composting has been practiced in Europe for many years. However, this technology is not problem-free as some environmental groups claim. For example, in Switzerland where compost has been used as fertilizer for over a century, this practice has resulted in the contamination of large tracts of farmland with heavy metals such as cadmium, rendering the land unsuitable for agriculture.

A composting facility in Sumter County, Florida started operations recently, after a long delay in receiving the operating permits from the D.E.R. In the Sumter County facility, incoming waste is sorted mechanically, magnetically and manually in order to separate recyclable materials from the biodegradable components. The latter are shredded and laid in windrows after being mixed with digestion enzymes to speed up the composting process.

Some concerns about composting include fears that toxic metals will find their way into compost that could later be used as fertilizer. Members of the public also focus their concern on the bad odor usually associated with such facilities, particularly if composting takes place in outdoor windrows rather than in enclosed vessels. A composting facility located in Dade County recently discontinued operations because of odor considerations.

Waste-to-Energy

Waste-to-Energy is the general name given to those facilities which burn municipal solid waste to produce electricity. In cold climates, some waste-to-energy plants may also produce low pressure steam which can be used for space heating.

Waste-to-energy plants can be classified into two general types: mass burning and refuse-derived-fuel (RDF).

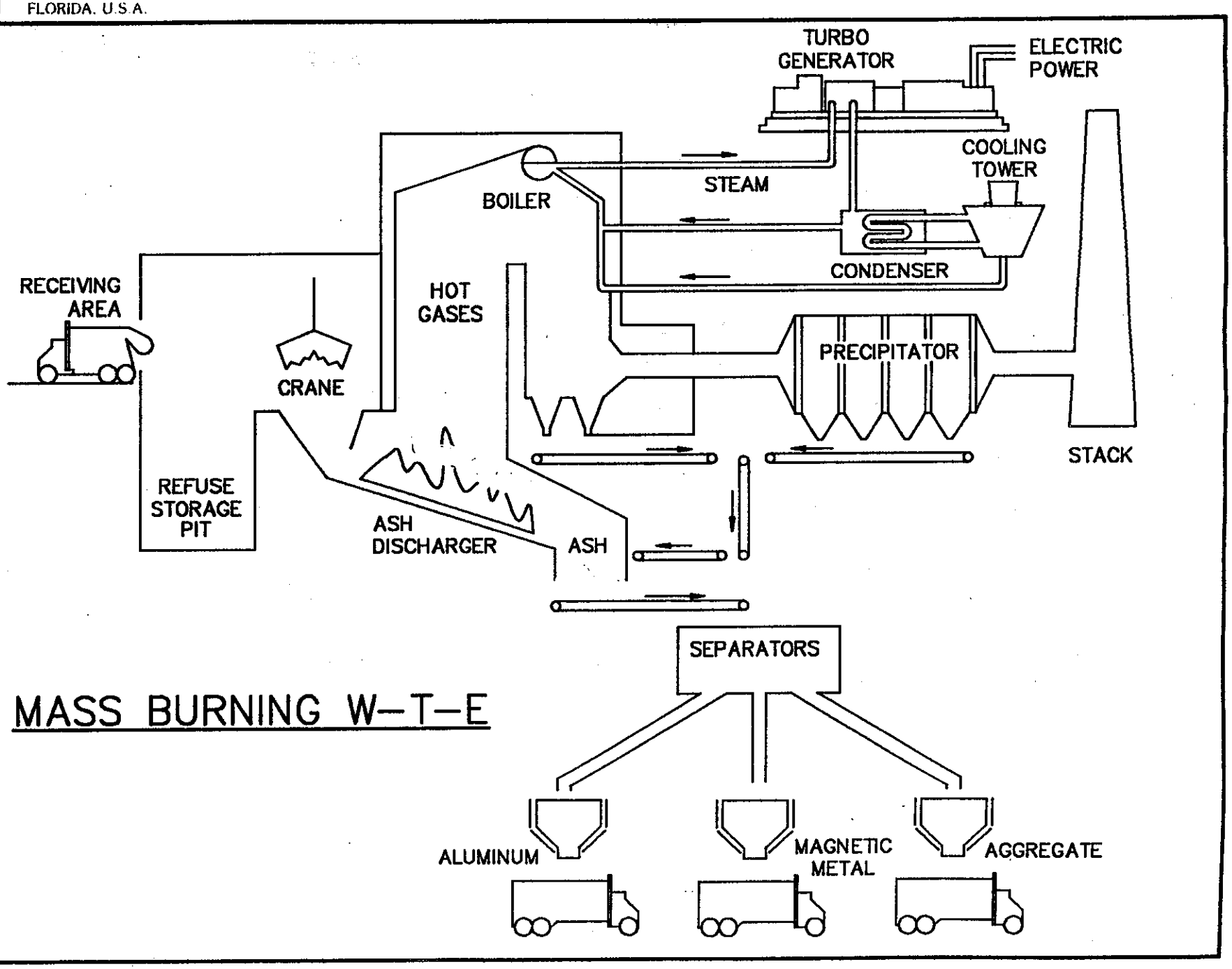
Mass burning plants receive municipal solid waste and feed it directly to a boiler for combustion. No pre-sorting takes place. Sorting, if any, will be done to the ashes.

Refuse-derived fuel (RDF) is the name given to the fuel produced after the incoming waste is sorted. The materials usually removed consist of ferrous substances, aluminum, and a heavy stream consisting mainly of glass.

The primary advantages of RDF over mass burning are that the fuel going to the boiler will have a higher caloric value and that valuable by-products can be sold. The main disadvantages are the investment and operating costs and the operating complexity of the sorting system. The slides show typical flow diagrams for mass burning and RDF type plants.

Most waste-to-energy plants operating in Florida today have either electrostatic precipitators or baghouses to control particulate emissions. This level of pollution control technology was acceptable a few years ago when most plants were build. However, new plants and those which contemplate expanding capacity will be required to install scrubbers to control odors and acid gas emissions. More on this subject will be discussed below.

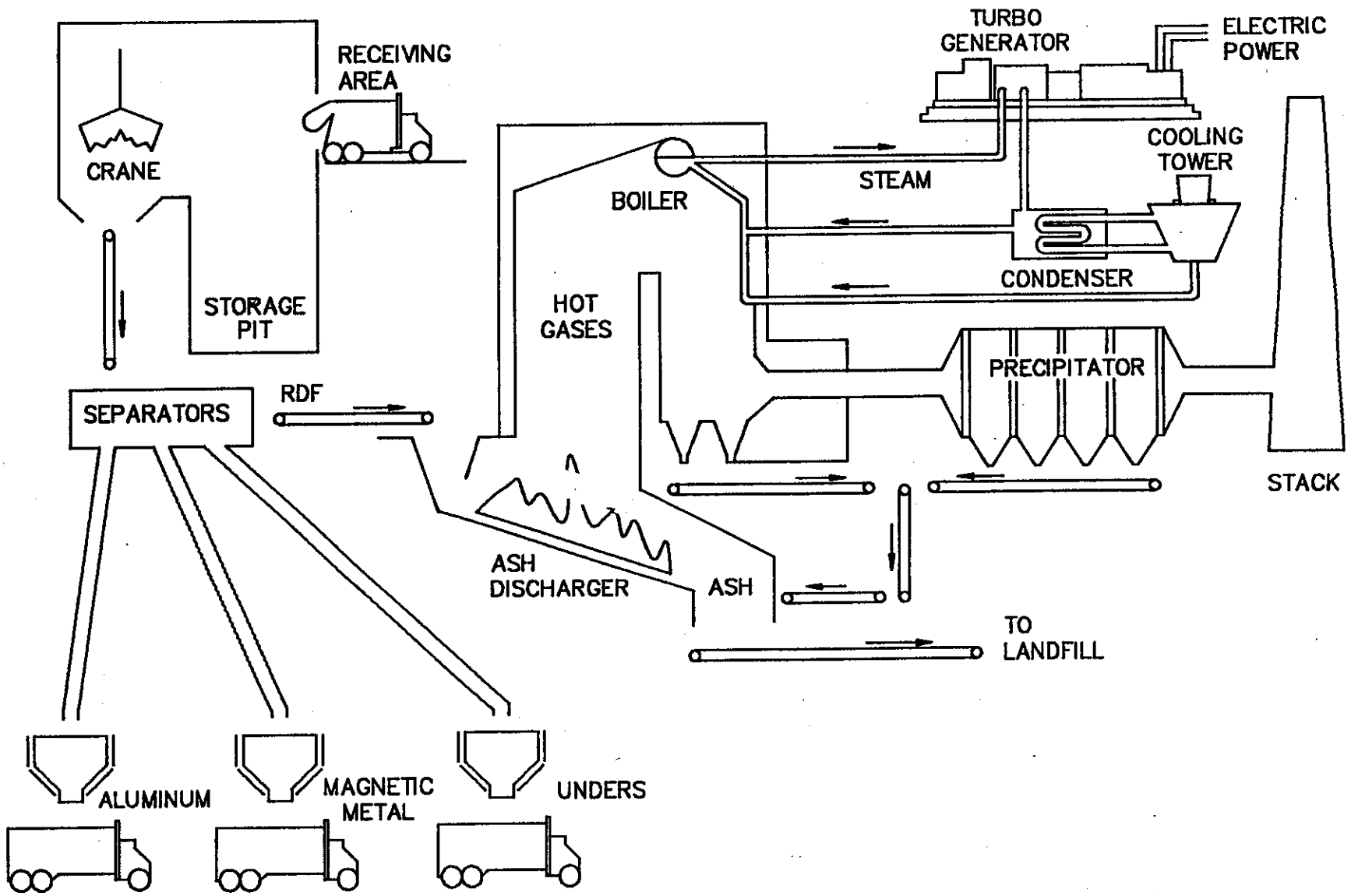
PRADO & ASSOCIATES, INC.
CONSULTING ENGINEERS
FLORIDA, U.S.A.



MASS BURNING W–T–E

PRADO & ASSOCIATES, INC.
CONSULTING ENGINEERS
FLORIDA, U.S.A.

REFUSE-DERIVED-FUEL W-T-E



WASTE-TO-ENERGY PLANTS CURRENTLY OPERATION IN FLORIDA:

Location:	Capacity in TPD:	Type:
Lakeland	420	RDF
Dade County	2000	RDF
Palm Beach County	2000	RDF
Broward County, North	2250	Mass
Broward County, South	2250	Mass
Lake County	450	Mass
Bay County	525	Mass
City of Tampa	1000	Mass
Hillsborough County	1200	Mass
Pinellas County	3000	Mass
City of Key West	150	Mass

THE ENVIRONMENTAL IMPACT OF WASTE-TO-ENERGY PLANTS

The environmental impact of Waste-to-Energy plants is felt in two general areas: air pollution and ash generation. Both present technical challenges.

The air pollution problem has attracted the most attention from the general public and environmental groups. Aside from the actual pollution generated by older plants without scrubbers, the concentration of garbage in one location has always created an odor problem. The problem, while difficult, is not unmanageable. A combination of closed receiving pits, removal of air followed by feeding it to the boilers, adsorption with activated carbon, and scrubbing can be used successfully to reduce, if not completely eliminate the problem.

Another concern associated with air pollution is that of the emissions at the stacks. Some older facilities featured dust control equipment such as electrostatic precipitators and baghouses. This equipment, while highly efficient for the removal of dust and solid particles, will not remove gaseous contaminants such as sulfur oxides, nitrogen oxides, other acid gases and heavy metal vapors.

The most technically advanced solution to the removal of gaseous contaminants is the use of alkaline scrubbers. They come in three major classes:

Dry feed/dry cake, in which a solid alkaline material such as ground limestone, lime, soda ash or sodium bicarbonate are introduced with the combustion air into the boilers. A chemical neutralization reaction takes place between the alkaline solids and the acid gases. The solids are then removed in a baghouse. This "dry/dry" system has the lowest capital cost, but also the lowest removal efficiency.

Wet (slurry) feed/dry cake,in which an alkaline slurry is sprayed into a scrubber vessel. The amount of moisture in the slurry is controlled in such a way that most of it will be evaporated when it comes into contact with the hot gases. The result is a dry product that is then removed in a solid removal system such as a baghouse. This "wet/dry" system requires the installation of a slurry handling system and scrubber vessels which add to the capital cost. The efficiency is, however, higher that that of the "dry/dry" system.

Wet/wet system, in which an alkaline slurry is sprayed into the scrubbers but sufficient water is incorporated into the slurry to assure the withdrawal of a slurry at the bottom of the scrubber. This slurry is continuously recirculated with a pump. As the alkaline material is

depleted, some slurry is withdrawn and make up is added. This "wet/wet" system features the highest acid gas removal efficiency, the lowest odor emissions, the highest utilization of the alkaline materials used as neutralizers and the potential removal of heavy metals such as mercury.

The disposal of ashes, while not so much in the public eye, is another problem associated with combustion of solid waste. Any toxic non-combustible components present in the incoming waste will be concentrated. Cadmium, from electric batteries, is a good example of a toxic material that will generally be present.

Our organization is currently investigating new technologies for the removal of mercury from stack gases and the immobilization of toxic metals in the ashes. We expect to be able to report the progress of our work at next year's meeting.

THE MSW PICTURE IN FLORIDA TODAY

Because of the high water table, the dependence on underground aquifers for water supply, and the population explosion in our state, the expansion of existing landfills and the search for new ones has become a very difficult task.

The high water table makes the leaching of hazardous substances more likely and more difficult to control. Once toxic substances find their way into either the Floridan or the Biscayne aquifers, they can damage the environment and contaminate the drinking water of large portions of Florida's population.

The alternative to disposing of municipal solid waste via combustion also creates conflicts and presents environmental challenges, which will be discussed below.

Most potential solutions confront the "not in my backyard" public reaction, which makes finding suitable sites for a disposal facility very difficult. Nevertheless, we expect that, despite some resistance on the part of various environmental groups, more waste-to-energy plants will be built in Florida in the future, and that some of the existing ones may be expanded in capacity. While this type of technology does present some potential environmental problems, they are of much lesser magnitude than the alternatives. In addition, the potential problems associated with Waste-to-Energy plants can be solved. Indeed most of them are on the road to an early solution.

One curious problem faced by local waste disposal administrators in Florida today is the sizing of the new facilities. If a facility is built to meet the current needs of a community, it will surely run out of capacity within a few years, given the rapid growth of Florida's population. On the other hand, if a plant is built to meet future anticipated needs, it may face the problem of not having enough waste to maintain full current capacity.

This second problem currently exists in Pasco county, whose new Shady Hills plant was designed anticipating needs eight years from now. In order to meet its 316,000 tons a year capacity, Hernando county will export 100 tons of trash a day for the next ten 10 years. Hillsborough county will send approximately 10,000 tons per month on a short term basis. A similar predicament is also faced by the new plant in Bay county in west Florida, where the facility has run short of trash because the population did not grow as expected. The waste-to-energy plant has tried using wood chips as fuel, at a cost of more than one million dollars over a two year period. At this time, trash is being imported from New York and New Jersey, where disposal costs are so high that it is cheaper to transport it to Florida.

ACKNOWLEDGMENTS

We give thanks to Mr. Charles T. Dunham, P.E. of Prado & Associates for his assistance in the preparation of the graphics and to Mr. Thomas E. Jones, P.E. of Birwelco-Montenay Inc. in Miami for his review and comments.