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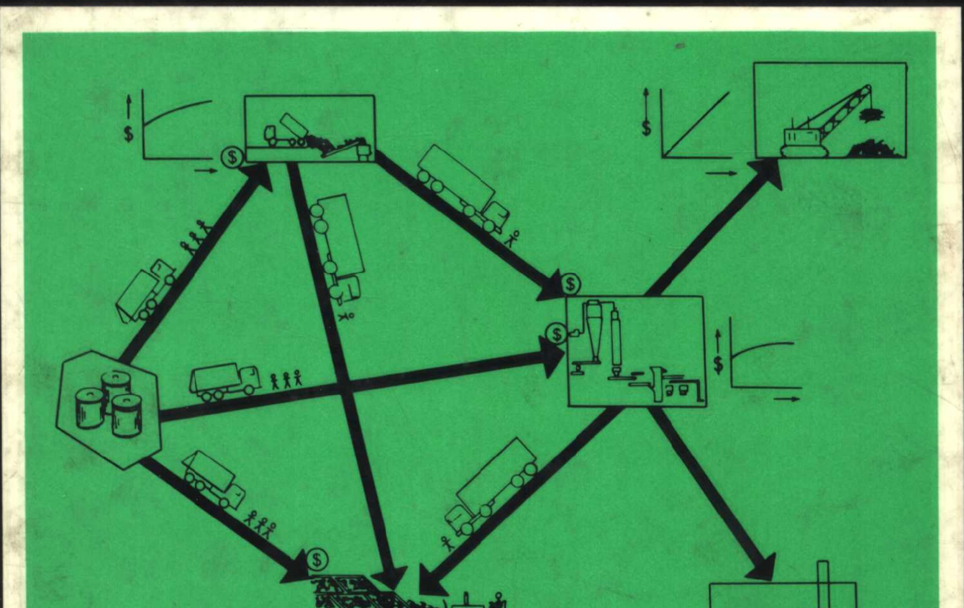
# Resource Recovery Economics

## Methods for Feasibility Analysis



Stuart H. Russell

# *RESOURCE RECOVERY ECONOMICS*

## *Methods for Feasibility Analysis*

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# PREFACE

Around the time of the 1973-1974 oil embargo, those of us in the solid waste management business began to hear and read with increasing frequency that the halcyon days of the "throw-away" mentality were gone forever to be replaced by more parsimonious use of resources and by the recovery of materials and energy from wastes. Although resource recovery was touted as the answer to both waste disposal and energy problems, it never seemed to garner the wide-spread acceptance which seemed so certain. Hundreds (perhaps thousands) of feasibility studies were performed, but only a few such studies resulted in operating facilities. In some communities, studies were done over, and over again in a seemingly interminable series of analyses of different options under different assumptions. Many times, facilities which were implemented did not perform as predicted, and most did not meet the economic projections contained in the feasibility studies. There are many political, economic, and technical reasons for the slowness with which the resource recovery industry has developed. One major problem has been the improper preparation of initial feasibility analyses which have either promoted bad projects or stopped good ones.

Now, almost ten years later, it appears that resource recovery has finally come of age. In some areas of the country there is actually competition among proposed resource recovery projects for the solid waste generated in a community. The continuous rise in energy costs, strident citizen opposition to the siting of new landfills, and federal incentives for the development of alternative energy sources have pushed resource recovery in many communities over the economic feasibility "hump." Resource recovery will not be feasible for every community, but it is now more important than ever to investigate the feasibility of resource recovery as a component in a community's solid waste management system. The purpose of this book is to give the reader the benefit of the experience of many people in the solid waste management field who have performed feasibility studies for resource recovery. A method developed over years of performing such studies in almost every type of community is presented to guide the reader through the steps necessary to perform a proper feasibility study.

The objective of the feasibility study methodology presented in this book is to avoid false starts and multiple studies by examining all available options on an equivalent basis. The study method gives the municipal official a structure, within which conflicting information from system vendors, potential private developers, and citizens can be reconciled in a comprehensive manner. The methodology is a "systems approach." That is, all elements of the solid waste management system (waste transport, processing, combustion, final disposal) are examined rather than individual facilities (landfills, transfer stations, resource recovery plants, etc.). The method calls for selecting a set of "system alternatives" and making a comprehensive economic comparison of them as the basis for a decision. Previously unpublished data from actual feasibility studies are presented to aid the reader in making comparisons. A hypothetical community, River City, is used as a numerical example to illustrate the required analyses in each of the study steps.

This book is dedicated to those municipal officials who wish to compare, without bias, the economics of resource recovery versus landfilling and other Conventional disposal methods. Conventional disposal methods may well prove more economical in many cases. It is hoped, however, that with a clear, logical, and comprehensive economic analysis, the quality of the resource recovery systems which prove feasible in the study will be higher in terms of technical and economic viability when built, than those based on an incomplete and unclear analysis. In the long run, quality is better than quantity for the resource recovery industry.

Stuart H. Russell

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# CHAPTER 1

## INTRODUCTION

### I. PURPOSE

Every municipal official concerned with solid waste management is confronted with questions from citizens, industry, and public officials about solid waste resource recovery every day:

> "Why don't we burn all of our garbage in a boiler and make electricity?"
>
> "I read somewhere that some cities are making fuel out of their solid waste. Should we be doing that in our community?"
>
> "Will resource recovery eliminate the need for our landfill?"
>
> "Why can't we burn all of our waste to make steam for our local industry?"
>
> "We should be composting all of our waste. Why aren't we doing this in our community?"
>
> "Why don't you buy my resource recovery equipment? It will make money for your community."
>
> "I was told that resource recovery has never been tried before. Shouldn't we just forget about it for our community?"

"Isn't it true that resource recovery is too expensive and has not worked in the existing plants around the country?"

These questions can be ignored or answered in a haphazard manner, but definitive answers will eventually be required. The demand for answers to these questions has been the result of a dramatic increase in interest in solid waste management and in the concept of recovering energy and materials from solid waste before disposal. This interest has been stimulated by an increased awareness of the environmental and economic problems associated with past disposal methods, and by the widespread shortages and increased prices of energy and materials.

In the past, town solid waste managers, city public works directors, or county solid waste officials have had only to deal with the most economical way to landfill solid wastes. As a result of this recent increase in interest in solid waste management, these same public officials are now being asked to make complex analyses of the various alternative disposal methods to determine which is best. Lack of information, the presence of inaccurate information and misconception, and most importantly, the lack of a sound methodology for performing these complex analyses has made the question of resource recovery foggy and confused.

The many considerations which go into selecting a solid waste disposal or resource recovery system for a given community can be put into three categories:

Technical/Economic
- What equipment has been proved?
- Is it reliable?
- Are there buyers for its products?
- Which equipment would best serve the buyers?
- How much does it cost to build?
- How much does it cost to operate?
- How does its cost compare with other alternatives?
- How can it be financed?

| | | |
|---|---|---|
| Environmental | - | How will it affect ambient water, air, noise, etc.? |
| | - | Will it improve or degrade the environment? |
| | - | Will it create aesthetic problems in its vicinity? |
| | - | Is it worth paying more money for environmental improvement? |
| Political/Social | - | is there political support for the concept? |
| | - | will citizen groups allow siting? |
| | - | is the money to build it best spent elsewhere? |

All of these questions must be resolved when making a sound decision. Each community has a different set of conditions, but in every case an economic analysis is the essential first step in the decision-making process. The equipment and its outputs must be defined before environmental analyses can be made. The plant or landfill site and cost must be defined before political support can be assessed. Indeed, many times the "dollars" issue is the sole determinant of a solid waste disposal or resource recovery system's viability.

It is the purpose of this book to focus on this economic analysis step of the decision-making process. This initial economic analysis step is many times called a "Feasibility Study." The thrust of the following chapters is not to tell the reader which resource recovery systems are the least expensive. This task is impossible because a sound economic analysis must include a variety of factors about a given community which can only be assessed by those in that community. The main purpose, rather, is to detail an economic analysis methodology for the public official or solid waste task force to follow. This methodology is a step-by-step procedure which can be used to sort out and reconcile conflicting information so that valid comparisons of the alternatives can be made.

With this methodology, many of those daily questions about solid waste disposal and resource recovery can be answered. The methodology can be used to support the continued operation of a local landfill, or if local conditions are favorable, to support the push for resource recovery.

The methodology covered in this book will result in the recommendation of a solid waste management system alternative (which may or may not include resource recovery) based on many initial assumptions. It is generally preferable for a community to form a resource recovery "task force" or "committee" comprising key decision-makers in the community to assist in the analysis and in making required assumptions. Many times members will include the person responsible for solid waste collection and disposal in the community, other public works personnel, a director of financial matters for local government, a representative of the applicable planning department and legal department. These members can represent a number of interested public entities (towns, villages, cities, counties, states) or a single entity. Private citizens may also be made part of the task force (e.g., members of environmental groups, private waste collection companies, representatives of major industries).

It is important for this committee or task force to take action on two matters before beginning the analysis. First, a project coordinator should be appointed. One person should be responsible for coordinating the results of all analyses and presenting the conclusions to the task force and others. This person must be committed to following through with project over a period of one year or more. The committee should also define its goals as soon as possible. Questions such as the following should be answered:

> Is cost the only consideration when choosing a solid waste system, or will environmental enhancement, energy conservation, or other considerations be factors?
>
> What political jurisdictions are to be involved in the feasibility study?

Is the primary purpose for considering resource recovery the disposal of solid waste, or might there be other purposes as well, such as economic development (attracting new industry), or becoming a primary energy producer?

How much control does local government wish to have over the operation of the resource recovery system?

Definitive answers to these and other questions early in the study will avoid time-consuming and costly misdirection of the economic analysis.

## II. DEFINITIONS

Any area of endeavor from biochemistry to skiing has its own set of terminology. Solid waste management and resource recovery has a terminology which has changed as rapidly as the technology in recent years. For this reason, many terms are ill-defined and confusing. The terms relative to the areas covered by this book will be defined in each individual chapter; however the definition of two general terms at this point in the book will be helpful in defining the scope of coverage. These two terms are "Solid Waste" and "Resource Recovery."

### A. Solid Waste

Solid waste goes by many names: refuse, garbage, MSW, rubbish, etc. A number of literature sources (1,2) give in-depth discussions of the nature of solid wastes. These references should be consulted for more detailed definitions. It is generally accepted that the term "solid waste" is a broad term encompassing all solid and semi-solid discarded materials. Although existing references use various categorizing schemes, solid waste can generally be divided into the following categories:

Residential - These wastes are often called "domestic" or "household" wastes. Wastes in this category consist of those which are normally collected from single and multiple family residences in a municipal collection program.

Commercial - These wastes come from a variety of commercial businesses engaged in wholesale and retail trade; finance, insurance, and real estate; health care and other services; and government. Infectious wastes from health care establishments or bulky wastes such as discarded equipment are not included. These are included in the "special" wastes category.

Industrial - This group include wastes from businesses engaged in manufacturing, transportation, communication, and public utilities. This is a highly-diversified group of wastes which can include paper, wood, and metal from packaging and office activity; food wastes from cafeterias; "special" industrial wastes such as fly ash, bottom ash, air pollution control solids, foundry sand, blast furnace slag, and others; and "Hazardous Wastes" as defined by 40 CFR Part 261 which include certain sludges, scrap chemicals, spent solvents, spent electroplating baths, and many other ignitable, corrosive, reactive, or toxic wastes.

Special - This is another highly-diversified group of wastes including construction/demolition debris, street sweepings, bulky wastes, infectious wastes, recreational wastes, junked automobiles, and tires.

Agricultural - These wastes consist primarily of live-stock and poultry manure, crop residue, and dead animals.

When considering resource recovery, a community should generally be concerned with the first two categories plus the packaging, office and cafeteria part of the Industrial waste category. Although these combined wastes can be as little as 30 percent to 40 percent of total solid waste generation, these are the only categories which can practically be used in a municipal resource recovery system. The term "processable" will be used in this book to describe these wastes. Most mechanical resource recovery equipment has been designed to process only these waste fractions which consist of about 78 percent paper and other organics, about 10 percent glass, about 10 percent metals, and other miscellaneous inorganics (3). Special, Agricultural and the non-processable Industrial wastes have widely varying compositions and/or a hazardous nature which cause handling and processing problems. In addition, since the processable waste fraction is normally collected in a municipal waste collection program by either public workers or contractors, the municipality usually has a certain measure of control over where the waste is deposited and data on how much is collected. Much of the non-processable Industrial, Special, and Agricultural wastes are handled and disposed by individual generators so these wastes never enter the municipal waste stream.

For these reasons, when the term "solid waste" is used in this book, the reference is to the processable waste fractions of the total waste stream unless otherwise noted.

## B. Resource Recovery

To many, the term "resource recovery" means a central, mechanical processing facility which separates materials and produces energy from solid waste. The term is ambiguous, however, because it is unclear whether recycling, baling, composting, landfill gas extraction, or others also are included in the term. Using its broadest interpretation, resource recovery means," any materials separation and/or chemical conversion of solid waste for the purpose of recovering materials or energy products." This definition includes manual separation by individual residents before collection (source separation), landfill gas extraction after disposal, as well as the various methods of mechanical processing and energy conversion between collection and disposal.

Although these pre-collection and post-disposal activities can be an important part of a complete solid waste management program, this