

**RECYCLING ECONOMIC INFORMATION PROJECT**

***FINAL REPORT***

*Recommendations for conducting a study of the  
U.S. recycling and reuse industries*

***Northeast Recycling Council***

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## **EXECUTIVE SUMMARY**

## ***Background***

This report presents the recommendations of the Recycling Economic Information Project, undertaken by the Northeast Recycling Council (NERC), with funding provided by the U.S. Environmental Protection Agency (EPA). The project's primary objective is to recommend to EPA a methodology for conducting a study of the U.S. recycling and reuse industries.

NERC undertook extensive research to develop the recommended methodology, including review of completed recycling economic impact studies, review of existing government and private sector sources of economic information, a survey of potential study users and interviews with dozens of technical experts, industry associations, government agencies and other organizations whose support will be crucial to the study's success. This report is intended to guide implementation of the national study, and its extensive reference information and industry definitions will be useful to a variety of recycling industry researchers. The methodology should be viewed as flexible and further refined during its implementation.

## ***Goals for the Recommended Study Methodology***

NERC's recommended methodology is designed to address the most important shortcomings of currently available economic information by:

- providing a baseline of the most useful information on 45 different categories of recycling and reuse businesses; and
- providing information and standard definitions to facilitate and improve future state and local studies of the recycling and reuse industries.

Anticipated uses for the study results include:

- Economic developers, bankers and other financiers will use the study to better understand the marketplace in which specific companies operate, and to evaluate financing deals involving recycling and reuse companies.
- Entrepreneurs will use the study results to identify and evaluate market opportunities in the recycling and reuse industries.
- Government decision makers will use the study results to evaluate existing and future policies involving recycling and reuse.
- Recycling advocates will use the study to enhance their understanding of the recycling and reuse industries, to target resources to promote the industries' growth and to increase awareness of recycling and reuse as private sector industries, among government decision makers, entrepreneurs, financiers, economic developers and others whose support is vital to recycling's continued growth.

## ***Types of Recycling and Reuse Businesses Included***

NERC identified 45 categories of recycling and reuse businesses and grouped these into five industry segments. The report defines the boundaries of recycling to include collection, processing and the first-stage product manufactured using scrap materials as feedstock (e.g., production of large paper rolls from pulp is included; converting paper rolls to sheets or envelopes is not). Reuse is divided into wholesale and resale. A variety of enterprises which support recycling and reuse businesses through equipment manufacture, brokering and other activities are also included. All non-hazardous scrap materials and used products are defined as within the recycling and reuse industries.

## **List of Recycling and Reuse Business Establishments Included in the Recommended Methodology** (\* indicates limited data will be obtained)

### **Recycling Collection**

- \*Government-staffed collection programs
- \*Hauler-based collection
- \*Disposal facility-based collection
- \*Commercial facility-based collection
- \*Manufacturing and industrial facility-based collection

### **Recycling Processing and Manufacturing**

- Recyclable material wholesalers
- Materials recovery facilities
- Construction & demolition debris processors
- Deinked market pulp producers
- Paper and paper board mills
- Other paper product producers
- Beneficiation facilities
- Glass container manufacturing plants
- Fiberglass insulation producers
- Other recycled glass product producers
- Detinning facilities
- Steel mills
- Iron and steel foundries
- Smelting and refining mills
- Nonferrous extruded product producers
- Nonferrous foundries
- Plastics reclaimers
- Plastics converters
- Crumb rubber producers
- Miscellaneous rubber product manufacturers

### **Recycling Processing and Manufacturing (Con't.)**

- Compost producers
- Miscellaneous organics product producers
- Aggregate and pavement mix producers
- Textile processors
- Used oil refiners (not for fuel)
- Household hazardous waste processors (for recycling only)
- Other recycling processors and manufacturers

### **Wholesale Reuse**

- Tire retreaders
- Electronic appliance demanufacturers
- Wood reuse
- Materials exchange services
- Motor vehicle parts
- \*Equipment remanufacturers
- Miscellaneous used merchandise sales (wholesale)

### **Retail Reuse**

- Miscellaneous used merchandise sales (retail)
- Repair and used product shops

### **Support Businesses**

- Recycling and reuse equipment manufacturers
- \*Consulting and engineering services
- \*Brokers
- \*Transporters

### ***Types of Information to be Obtained***

The recommended methodology is consistent with the following priorities which NERC established for the types of information to obtain in the study:

*First Priority — Obtain for each category of recycling, reuse and support business the data necessary to document industry size: number of firms, total throughput recovered by material, total employment, total wages, total sales and value added.*

*Second Priority — Obtain the data required to calculate total economic impacts in a standardized manner at the local and regional level, and provide guidance to assist in applying models.*

*Third Priority — Obtain all other economic information wherever possible.*

The methodology is intended to obtain first- and second priority information for all categories of recycling processing and manufacture, most reuse business categories and for equipment manufacturers. To reduce costs while targeting resources to value-adding economic activities, data collection for the recycling collection and support business categories is limited largely to compilation of existing data. Depending on resource availability, detailed data on support business categories may also be developed for selected geographic regions in which economic models are applied. For most business categories it will be possible to obtain additional data beyond these top priorities. Due to concern over disclosure and accuracy, much of the information will be tabulated at the regional and national levels, and not at the state level.

### ***Overview of the Recommended Methodology***

The recommended methodology includes nine distinct information gathering steps, involving use of existing information sources, coordination with existing survey programs, developing databases of businesses and conducting new surveys, and applying economic models in selected geographic regions. Because the recommended methodology will need to be refined during implementation, NERC recommends it be implemented first at a regional level as Phase One of a national study. NERC estimates that implementing the study in this two-Phase approach will take at least 15 months to complete, that and consultant services will cost between \$260,000 and \$305,000. While the bulk of the study should be undertaken by a consulting team with specialized technical expertise, NERC recommends that an intermediary organization, such as EPA, the National Recycling Coalition or the Northeast Recycling Council, be responsible for securing resources as needed from states and other organizations, managing the consultant contract, assisting implementing and refining the methodology and coordinating discussions to secure information and assistance from trade associations, state agencies and other organizations. To be most effective, the study should be updated periodically and possibly expanded to include a broader range of information. The cost of replicating the study will likely be significantly reduced, since much of the estimated cost is for one-time refinement of the recommended methodology.

# **1. INTRODUCTION**

## **1.1. Overview**

This report presents the recommendations of the Recycling Economic Information Project, undertaken by the Northeast Recycling Council (NERC), with funding provided by the U.S. Environmental Protection Agency (EPA). The project's primary objective is to recommend to EPA a methodology for obtaining economic information on the U.S. recycling and reuse industries.

The Recycling Economic Information Project was motivated, in part, by the success of several state and multi-state recycling economic impact studies. Using different data collection methodologies and industry definitions, these studies quantified employment, value added, sales and other measures, and have proven extremely useful to government and private sector stakeholders in recycling. The Project lays the groundwork for obtaining economic statistics on the nation's recycling industry, while capitalizing on the collective experience of past studies and examining the role that existing government and private sector data collection programs can play. Early in the project, a decision was made address reuse as well as recycling.

## **1.2. Report Organization**

This report is intended to guide implementation of a study of the U.S. recycling and reuse industries. In addition, its detailed reference information and industry definitions should also benefit other researchers of recycling economics, especially authors of state and local recycling economic impact studies, who are encouraged to adopt the standards established in this report. Chapter One provides an introduction to the report. Chapter Two documents the need for a national economic study of the U.S. recycling and reuse industries. Chapter Three summarizes the recommended methodology for conducting the study, including an estimated time line and budget and clarification of several important implementation issues. Chapter Three also lists additional recommendations to government and private organizations designed to enhance the quality and availability of economic information on the recycling and reuse industries. The remainder of the report provides justification for the recommended methodology. Chapter Four provides justification for the types of information recommended to be obtained in the study. Chapter Five provides justification for the types of businesses recommended to be included in the study. Chapter Six provides justification for the recommended approaches for obtaining the information.

Appendix A describes 45 categories of recycling and reuse businesses, including typically assigned *Standard Industrial Classification* (SIC) codes. Appendix B reviews sources of recycling economic information, including contact information. Appendix C lists sources of databases and directories of recycling and reuse business establishments. Appendix D summarizes the results of a survey of potential study users. Appendix E is a brief consultant report addressing issues associated with determining value added and economic impacts. Finally, Appendix F is a brief consultant report covering private business data sources.

## 2. THE NEED FOR A STUDY OF THE U.S. RECYCLING AND REUSE INDUSTRIES

### 2.1. Types and Uses of Economic Information

Economic information is essential to the establishment and growth of any industry. Entrepreneurs, investors, bankers, financial analysts, economic developers, government decision makers and others rely on economic information to understand industry trends, to determine priorities for allocating resources and building market share, and to evaluate specific growth opportunities. Table 2.1 lists six broad categories of economic information, specific examples of data types within each category, and examples of key uses for the information.

**Table 2.1 Examples of Types and Uses of Economic Information**

Examples of Economic Information	Key Uses
<b>Industry size</b> (e.g., employment, annual wages, annual sales, annual production, number of firms)	Enhances the understanding of an industry by the financial community, government decision makers and the general public. Enables broad comparisons with other industries.
<b>Investment information</b> (e.g., annual capital investment, planned expansions and investments, sources of capital, uses of capital, data on of mergers, acquisitions and initial public offerings)	Assists entrepreneurs, lenders and investors in broadly identifying and evaluating business opportunities.
<b>Financial performance</b> (e.g., stock values of public companies, average performance of investments, average financial performance statistics and ratios, number of loan defaults, number of bankruptcies)	Assists lenders and investors in broadly evaluating financial transactions and in comparing specific companies with industry norms. Assists entrepreneurs in identifying and evaluating market opportunities.
<b>Market information</b> (e.g., material and product price trends, production capacity by industry sector, U.S. imports and exports of materials and products, domestic recovery and consumption of materials)	Assists lenders and investors in understanding the market position of particular firms and in evaluating business plans. Assists entrepreneurs in identifying market opportunities. Assists industry advocates with market development strategic planning and tracking overall progress.
<b>Facility-specific information</b> (e.g., average statistics and case studies of actual establishments including information such as wages per employee, number of construction and permanent employees, annual sales, capital costs, total labor costs, skill levels required of workers, energy, water, other resource requirements, building requirements, type of equipment/technology used)	Assists entrepreneurs in identifying and evaluating specific business opportunities. Assists local business development programs in targeting and assisting specific business development projects.
<b>Net economic benefits</b> (e.g., measurements of value added and the net economic impacts of a specific business development project or an entire industry; measurements of the net benefits and costs of specific economic activities or policies accounting for	Encourages sustained support for an industry among government policy makers, financiers and the general public. Assists in evaluating the broad costs and benefits of particular economic activities or government policies. Assists in evaluating the

Examples of Economic Information	Key Uses
tradeoffs with other industries)	desirability of siting specific types of business establishments in a particular community or region.

While economic information is essential to the growth of all industries, it may be particularly important to the recycling and reuse industries. Even after a period of significant growth, many segments of these industries remain poorly understood in the financial and economic development communities. This is especially true of the many entrepreneurial ventures involving diverse products and services not currently tracked by any organization. Future growth in recycling and reuse is likely to occur in these relatively immature market segments such as compost production, electronics demanufacturing, construction and demolition debris processing, and processing technologies for high volume materials like tires, mixed paper and mixed plastics. Numerous studies have determined that a lack of information on these relatively new types of business is a significant financing barrier.

Economic information is also important to recycling and reuse because government policies on solid waste management — sometimes key drivers of the industry — are being reexamined, with increasing emphasis on their economic costs and benefits. Without broad information on the economic characteristics of recycling and reuse, the effectiveness of these policies cannot be adequately evaluated. Finally, the dearth of information on most sectors of the recycling and reuse industries makes it difficult for entrepreneurs to identify and evaluate new business opportunities.

## 2.2. Shortcomings of Currently Available Information

To varying degrees, economic information on the recycling and reuse industries is available from industry publications, trade associations, government agencies, private financial data companies and non-profit organizations. (Appendix B lists many of these sources.) Though these sources provide a wealth of useful information, they also have many shortcomings, including:

- While a wide range of information is available on certain industry categories (e.g., paper and steel mills,) very little information is available on others (e.g., compost producers or construction and demolition processors.)
- Since existing information must be gathered from dozens of different sources, compiling statistics can be laborious and costly.
- Most government and private economic data programs can provide little useful economic information on recycling and reuse business establishments since they are classified under dozens of different *Standard Industrial Classification* (SIC) codes, usually along with other firms not involved in recycling and reuse.
- Aggregating and comparing statistics from multiple sources is complicated by the

absence of standard definitions for recycling and reuse activities, business establishments and measures of economic activity.

- Many studies provide an excellent snapshot of industry characteristics, but are not updated regularly and therefore quickly become outdated.

### **2.3. Goals and Intended Uses of the Study**

Obtaining all types of economic information on all segments of the recycling and reuse industries would be prohibitively expensive. The methodology presented in this report is designed to address the most important shortcomings of currently available economic information by:

- providing a baseline of the most useful information on each industry category, including those for which little information is currently available;
- compiling key data from existing and new sources into a single publication to facilitate its use; and
- providing information and standard definitions to facilitate and improve future studies of the recycling and reuse industries.

It is anticipated that the results of the study will be used primarily in the following ways:

- Economic developers, bankers and other financiers will use the study to better understand the marketplace in which specific companies operate, and to evaluate financing deals involving recycling and reuse companies.
- Entrepreneurs will use the study to identify and evaluate market opportunities within the recycling and reuse industries.
- Government decision makers will use the study results to evaluate existing and future policies involving recycling and reuse.
- Recycling advocates will use the study to enhance their understanding of the recycling and reuse industries, to target resources to promote the industries' growth and to promote increased awareness of recycling and reuse as private sector industries to government decision makers, entrepreneurs, financiers, economic developers and others whose support is vital to recycling's continued growth.

### **3. RECOMMENDED METHODOLOGY FOR CONDUCTING THE STUDY**

#### **3.1. Overview**

This chapter summarizes NERC's recommended methodology for conducting an economic study of the U.S. recycling and reuse industries. To facilitate allocating resources to implement the methodology, the recommendations are presented in three parts. Section 3.2 covers recommendations for obtaining economic information on recycling and support businesses; Section 3.3 covers recommendations for obtaining economic information on reuse businesses; and Section 3.4 covers recommendations on applying economic models to obtain a variety of additional useful information, including estimates of indirect and induced economic impacts. Section 3.5 addresses several key issues and is intended to clarify and guide implementation of the methodology. Section 3.6 presents an estimated time line and budget for implementing the recommended methodology. Finally, Section 3.7 presents additional recommendations identified during the project which would enhance the quality and availability of recycling economic information.

#### ***Summary of the Recommended Methodology***

The recommended methodology includes nine information gathering steps, and involves a combination of strategies to obtain information on 45 different categories of recycling and reuse businesses. Because the recommended methodology will need to be refined during implementation, NERC recommends it be implemented first at a regional level as Phase One of a national study. NERC estimates that implementing the study in this two-Phase approach will take at least 15 months to complete, from initial preparation of a request for proposals for Phase One through publication of a final report for Phase Two, and costs for consulting services will run between \$260,000 and \$305,000. While the bulk of the study should be undertaken by a consulting team with specialized technical expertise, NERC recommends that an intermediary organization, such as EPA, the National Recycling Coalition or the Northeast Recycling Council, be responsible for securing resources as needed from states and other organizations, managing the consultant contract, assisting in implementing and refining their methodology and coordinating discussions to secure information and assistance from trade associations, state agencies and other organizations. To be most effective, the study should be updated periodically and possibly expanded to cover additional information. Should the study be replicated in future years, the cost will likely be significantly less, since much of this cost is for one time refinement of the recommended methodology.

#### ***Types of Information to be Obtained***

The recommended methodology is consistent with the following priorities which NERC established for the types of information to obtain in the study (see Chapter 4 for detailed justification):

*First Priority — Obtain for each category of recycling, reuse and support businesses the data necessary to document industry size: number of firms, total throughput recovered by*

*material, total employment, total wages, total sales and value added.*

*Second Priority — Obtain the data required to calculate total economic impacts in a standardized manner at the local and regional level, and provide guidance on applying models.*

*Third Priority — Obtain all other economic information wherever possible.*

First and second priority information will be obtained for all recycling processing and manufacturing business categories, for most reuse business categories and for equipment manufacturers. More limited data will be obtained for recycling collection businesses, most support businesses and for certain reuse business categories. For most business categories it will be possible to obtain additional data beyond these top priorities. Due to concerns of cost and disclosure, much of the data may need to be tabulated at the regional and national level, and not at the state level.

### **3.2. Recommendations for Recycling and Support Businesses**

The steps below are recommended to obtain economic information on recycling and support business categories.

*Step One — Evaluate the potential for obtaining first priority information from existing sources for the following business categories:*

- *Materials Recovery Facilities*
- *Recyclable Material Wholesalers*
- *Deinked Market Pulp Producers*
- *Paper and Paper Board Mills*
- *Steel Mills*
- *Iron and Steel Foundries*
- *Nonferrous Smelting and Refining Mills*
- *Nonferrous Extrusion Mills*
- *Nonferrous Foundries*
- *Textile Processors*

This step requires confirming the appropriateness of using information from each source, negotiating agreements to republish or use the existing data in calculations, and actually obtaining the data. Section 6.7 lists the specific information sources to be evaluated, as well as alternative options for obtaining data if the existing sources are determined to be inadequate.

*Step Two — Evaluate the potential for obtaining information by coordinating with existing survey programs covering the following business categories:*

- *Plastics reclaimers.*

Depending on whether the existing information sources suggested for the business categories in step one prove to be feasible, it may be necessary to explore additional survey coordination. This step requires confirming the appropriateness and feasibility of coordinating with each survey program, negotiating agreements to adjust the survey programs to obtain the desired information,

and working with each organization to conduct the survey. Section 6.7 lists the specific survey programs to coordinate with, as well as alternative information collection approaches in case agreements cannot be secured. Coordinating with existing survey programs may not be feasible in both phases if the study is implemented in two phases as recommended.

***Step Three — Develop a database of business establishments and conduct surveys covering the following business categories:***

- ***Construction & Demolition Debris Processors***
- ***Other Paper Product Producers***
- ***Beneficiation Facilities***
- ***Glass Container Facilities***
- ***Fiberglass Insulation Plants***
- ***Other Recycled Glass Product Producers***
- ***Plastic Converters***
- ***Detinners***
- ***Crumb Rubber Producers***
- ***Misc. Rubber Product Producers***
- ***Compost Producers***
- ***Misc. Organic Product Producers***
- ***Other Recycling Processors and Manufacturers***
- ***Aggregate and Pavement Mix Producers***
- ***Used Oil Refiners***
- ***Household Hazardous Waste Processors (for recycling only)***
- ***Recycling and Reuse Equipment Manufacturers***

This is the most resource-intensive step in the recommended methodology. Developing a database of business establishments in these categories will involve negotiation and coordination with numerous organizations. Key sources for developing databases for each category are identified in Section 6.7, and directories and databases are listed in Appendix C. Once complete, the database could include more than 7,000 business establishments, not including plastics converters (for which no reliable estimates are available). Depending on the success of using existing information and coordination with existing survey programs, additional business categories may need to be surveyed. Since a 100% response rate will not be achieved, it will be necessary to apply appropriate extrapolation techniques to derive total statistics for each category.

For some business categories — for example, plastics converters— it may not be feasible to develop a reasonably comprehensive database of businesses. In this case the total number of establishments can be estimated based on existing information and survey responses from reclaimers who supply the converters, and a limited sample survey can be conducted and extrapolated based on per ton or per facility averages.

***Step 4 — For the business categories listed in Table 3.1, obtain economic information available from existing sources, through limited surveys, and/or by deriving estimates using desk-top estimates.***

This step involves obtaining a more limited amount of information than for the categories included in Steps one through three. Table 3.1 lists specific data gathering steps for the business categories covered in this Step. Due to cost concerns and logistical issues, attempting to obtain all priority information on these business categories is not recommended.

**Table 3.1. Recommendations for Limited Data Collection Approaches Covering Recycling**

## Collection and Support Businesses

Business Category	Recommended Approach
<p>Recycling Collection Industry Segment:</p> <ul style="list-style-type: none"> <li>● Government-Staffed Collection Programs</li> <li>● Hauler-Based Collection</li> <li>● Disposal Facility-Based Collection</li> <li>● Commercial Facility-Based Collection</li> <li>● Manufacturing and Industrial Facility-Based Collection</li> </ul>	<ol style="list-style-type: none"> <li>1. Estimate the number and type of municipal programs, total tonnage recovered by material type, value of recovered materials and average program costs through existing sources.</li> <li>2. Evaluate the potential to estimate residential recovery based on state tonnage data, and to estimate commercial/industrial recovery by subtracting these figures from EPA's total national estimates.</li> <li>3. Evaluate conducting a limited survey of major haulers as resources allow to estimate data on hauler-based recycling activity.</li> <li>4. Seek lists of commercial facility recycling establishments and available data from industry trade groups and state recycling agencies.</li> </ol>
<p>Support Businesses Industry Segment:</p> <ul style="list-style-type: none"> <li>● Consulting and Engineering Services</li> <li>● Brokers</li> <li>● Transporters</li> </ul>	<ol style="list-style-type: none"> <li>1. Estimate the number of businesses based on existing directories and databases.</li> <li>2. Obtain total sales data for equipment manufacturers from Environmental Business International.</li> <li>3. Obtain estimates of employment, sales, wages and value added by applying economic models, as in Steps Seven through Nine below, in select states. Evaluate the potential for extrapolating based on state results to estimate national data.</li> </ol>

### 3.3. Recommendations for Reuse Businesses

The steps below are recommended to obtain economic information on the reuse industry. NERC's research on reuse was less rigorous than for the recycling industry. This was due to resource limitations and the relative scarcity of existing studies to guide research on reuse. Nevertheless, because of its relevance and the fact that a significant amount of economic information can be obtained on the reuse industry at relatively low cost, NERC's recommended methodology does include several reuse industry categories. Information on the reuse industry obtained through this study should be reported separately from the recycling industry, and additional research should be conducted to further refine industry definitions.

*Step Five — Obtain information from existing sources for the following business categories:*

- *Tire Retreaders*
- *Motor Vehicle Parts*
- *Miscellaneous Used Merchandise Sales (Retail)*
- *Repair and Used Product Shops*
- *Equipment Remanufacturing*

This is a relatively simple and low resource step, since existing data for each listed category, except equipment remanufacturing, is tabulated by SIC code by the U.S. Bureau of Census at the County, State and National levels. For equipment remanufacturing, the recommendations call for evaluating the raw data used in a recent study and securing agreements to republish it, possibly at a greater level of detail than used in the original study. Unlike the recommendations for the recycling industry, if existing data is determined to be inappropriate, resources will probably not allow surveys to be conducted on these categories, given the very large number of establishments.

*Step Six — Develop a database of business establishments and conduct new surveys covering the following business categories:*

- *Electronic Appliance Demanufacturers*
- *Other Wholesale Reuse*
- *Wood Reuse*
- *Materials Exchange Services*

As for the recycling industry, developing databases and conducting surveys is the most resource-intensive step in the recommended methodology for reuse. However, for reuse, this step involves only a small number of categories containing a relatively small number of business establishments (approximately 1,000). Specific sources for developing databases are listed in Section 6.7.

### **3.4. Recommendations for Using Economic Models**

Steps One through Six will yield a significant amount of information on the activities undertaken directly by each category of recycling and reuse business, including employment, wages, sales, throughput and number of firms. The steps listed below will provide additional information to assist in estimating the total, regional economic impacts of industry categories or specific facilities, including indirect impacts (accruing due to the activities of suppliers and customers of recycling and reuse businesses) and induced impacts (accruing due to the purchases of employees at retail and other establishments). Because these steps involve estimation of economic *impacts*, they are likely to be more controversial than the preceding steps. And, because they are likely to involve additional surveys and require technical expertise beyond that required for Steps One through Six, they will add to the overall cost of implementing the methodology. These steps are included in NERC's recommended methodology nevertheless, because of the demand for this type of information by market development officials throughout the nation, and the significant need for standardization in methods of measuring economic impacts of recycling and reuse businesses.

*Step Seven — Evaluate the need for appropriateness of using existing intermediate input data on each recycling and reuse business category.*

Intermediate input data are estimates of the amount of expenditures on inputs such as raw materials, chemicals, electricity, accounting services and other items necessary to production.

They are usually expressed as a dollar amount per \$1,000 in output for a particular type of industry. Although at least three previous studies used existing intermediate input data in order to apply economic models to the recycling industry, no systematic review of the appropriateness of using this data has been conducted. This is essential since it is precisely this data which determines the differences in local economic impacts between recycling and non-recycling establishments. This step requires expertise in applying economic models, and involves interviewing managers of businesses in the above categories and reviewing existing intermediate input data available through the U.S. Bureau of Economic Analysis to determine whether existing data could be used in applying economic models to each business category.

***Step Eight — As necessary, conduct additional, limited sample surveys to obtain key “intermediate input” data.***

This step involves designing and conducting additional surveys of the business categories identified in Step 7 for which existing intermediate input data is not sufficient. The surveys need not be as rigorous as those conducted to obtain “direct” data in Steps 3 and 6. The goal of the surveys is to estimate the most important inputs to the production process for each business category which are likely to deviate from those in similar categories.

***Step Nine — Select a small number of states and/or other geographic regions and apply an appropriate economic model to all business categories except those in the recycling collection and support business industry segment.***

Once the direct economic data is obtained in Steps 1 through 7, and intermediate input data is obtained in Steps 8 and 9, this becomes a relatively straight-forward task. Depending on resource availability, a small number of case study regions should be selected which illustrate a range of conditions. The resulting information, for each selected region, will include:

- Estimates for each case study region, for each industry category, of total impacts, including direct, indirect and induced employment, wages, sales, value added and (depending on the model employed) local, state & federal tax revenue.
- Estimates of economic impacts associated with several categories of support businesses, including brokers, equipment dealers, consultants & engineers and others.
- Estimates of *multipliers* for each industry category. (The ratio of total impacts to direct impacts.)
- Intermediate input data and standards for conducting economic impact analyses of recycling businesses at the state and local levels.

Because of controversy over how to measure the economic impacts of recycling and reuse businesses, the results should be reported separately for processors and for manufacturers. (See Sections 4.4 and 6.6.)

### **3.5. Clarification of Key Implementation Issues**

The information below is intended to further clarify and guide implementation of the methodology presented in Sections 3.2 through 3.4. Additional, detailed clarification of the recommendations is also provided in the remaining chapters and appendices of this report.

***The recommended information gathering steps for each business category should be evaluated and revised during implementation of the study.***

Given resource limitations, NERC was unable to conduct a detailed evaluation of every existing source of information and survey program, or to negotiate specific agreements with the managers of these programs. The recommendations are based on the information available to NERC at the time this report was prepared, and the information sources and survey programs recommended to be used should be re-evaluated to confirm their ability to provide the needed data, their consistency with industry definitions used in this report, their cost and the ability to secure agreements where necessary. Given this need to re-evaluate information sources, the steps in the recommended methodology should not necessarily be implemented sequentially. Rather, they should be viewed as an initial implementation strategy which will need to be revised as the study progresses.

***The most appropriate methods for filling information gaps must be determined during implementation of the methodology.***

Because it will be impossible to obtain a 100% response rate in surveys, it will be necessary to fill gaps in information for many business categories. One option for filling gaps is to obtain data from a private financial firm, state data center or other source, as listed in Appendix B. Another option is to extrapolate the results from a limited sample to estimate total statistics for the entire business category. Techniques used in past recycling economic studies include extrapolation based on average figures per ton of material handled, per employee or per business establishment. Extrapolation can be complicated by the significant variation in size of business establishments within many industry categories. No recycling-specific research was identified which evaluates the various options for filling data gaps, and the best approach should be determined for each category based on the quality of data that is available and the resources available for obtaining data from secondary sources. The approach ultimately used should be carefully documented to facilitate replication.

***Relying on a range of different approaches to obtain information is necessary.***

Ideally, the recommended methodology would involve obtaining primary data from all recycling and reuse businesses through a consistently applied survey design. Unfortunately, because the resources available to implement the study will be limited, and because the industries are so large and diverse, this approach is not feasible. Consequently, the recommended methodology involves a combination of approaches to obtain information.

***Given the reliance on multiple information gathering approaches, data inconsistencies should be anticipated and clearly noted when reporting results.***

Ideally, the data obtained in an economic study would be 100% consistent in terms of the activities covered, time periods covered, degree of accuracy, etc. In practice, this is *never* the case, regardless of the source of economic information. Inaccuracies arise in all economic studies due to misinterpretation or reporting errors by survey respondents, incomplete identification of the survey population, statistical analysis errors, etc. Given that inaccuracies are inevitable, and given the particular challenge and cost of obtaining economic information on the recycling and reuse industries, NERC recommends a methodology that draws on multiple information gathering approaches. This inevitably will involve inconsistencies in the data obtained. Every effort should be made to maximize the quality of data obtained; but study implementors should expect inconsistencies to arise, and should clearly document these when reporting final results.

***The data requested from companies and establishments in which only a portion of activities are defined as recycling or reuse should be clearly defined.***

The recommended methodology is based on obtaining data on business establishments — specific facilities at distinct locations. In practice, data will often be gathered at the company level. For companies which operate multiple establishments, only data on those facilities in which activities covered in this report occur should be obtained. In a situation in which both recycling activities covered in this report and other activities not covered occur at a given establishment, it usually will not be possible to separate the data. If necessary, information should be obtained for the establishment as a whole, and this should be clearly noted in reporting the results. This may be necessary, for example, for metals processing and manufacture, where several stages of manufacturing may be conducted at the same facility; or for any type of manufacturer which operates multiple production lines, only some of which use recycled materials. If necessary, the business categories can be revised to separately report data which incorporates non-recycling activities.

***The exact information to be requested in surveys should be determined during implementation.***

Experienced survey designers uniformly agree that achieving a significant survey response rate requires that surveys be as simple and short as possible, and that multiple contacts be made — generally an initial mailing followed by at least one phone call. In general, response is reduced significantly if information is requested which is deemed sensitive (e.g., financial performance statistics), if the respondent is required to conduct research or perform calculations (e.g., estimating recycling-specific statistics for a facility that includes both recycling and non-recycling activities), or if the request is not clear and understandable to the respondent or too much information is requested. For these reasons, NERC has targeted only a small number of top-priority data types — employment, wages, sales, and tons of recovered materials consumed or produced. However, NERC recommends that survey forms be tested prior to full scale mailings, and implementors should experiment with the potential to obtain additional information which

does not violate the guiding principles listed above. For example, respondents may welcome an opportunity to offer suggestions on topics such as predicted market growth trends, barriers to growth or the need for government assistance.

***Appropriate policies and procedures on confidentiality and disclosure of information should be adopted early in the study, and be clearly explained to participants.***

These policies and procedures should be developed early in the project to help encourage government agencies, trade associations, business establishments and others to provide support and existing data, or to coordinate existing survey programs. In general, the policies should provide assurances that no information will be divulged which would allow the reader to infer sensitive statistics on a particular establishment. Some guidance may be available from the U.S. Department of Commerce, Bureau of Census, although that organization's detailed confidentiality policies are themselves confidential. Notwithstanding the need for confidentiality, efforts should also be made to seek appropriate agreements to share raw data with recycling industry researchers, under specified conditions, as discussed below.

***The study is designed to provide data at the regional and national levels, but opportunities should be sought wherever possible to provide state-level data.***

State recycling advocates have consistently cited the need for state-specific recycling industry data. For many of the intended study uses, state-specific data may be more effective than regional or national data. This presents a dilemma, since in many states the number of establishments in some categories may be very small, reducing the accuracy of extrapolations based on small samples and potentially raising concern over disclosure of proprietary data. In conducting the study and tabulating results, every effort should be made to provide state level data wherever possible. There are at least three options for maximizing state-level information. First, where feasible, estimates for multiple categories can be combined to produce a broader state-level estimate. Second, states should be offered the opportunity to obtain full state-level information by providing additional funding to the study. Third, appropriate arrangements should be sought to ensure that raw data obtained during the national study, and raw data obtained in separate state-sponsored studies is mutually available. This will allow states conducting their own studies in accordance with the standards set out in this report to contribute directly to a national study, and conversely will allow states to later augment the data obtained in the national study to develop more comprehensive state-level data.

***Developing a database of business establishments requires a well-developed strategy which will be determined by the willingness of owners of existing databases to assist the study.***

This is a highly resource-intensive task requiring detailed interaction and negotiation with dozens of organizations. The database needs to be as complete as possible for the business categories which will be surveyed. Unfortunately, it is likely that owners of some of the most comprehensive databases will not provide full access to their databases, and the study implementors may need to consider alternative scenarios whereby certain business categories are surveyed, under contract, by the database owners directly. This will complicate the already difficult task of performing "merge-purge" operations to eliminate duplicate records and ensure that the database is as

comprehensive as possible. Since there is an existing source of information on the largest category of recycling establishments, approximately 10,000 recyclable material wholesalers, the ultimate size of the national database may be restricted to less than 9,000 records.

***Specialized technical expertise is required to properly implement the methodology.***

The recommended methodology should be implemented by a team with considerable experience in conducting economic impact studies. Specific areas of expertise required include survey design, statistical analysis, familiarity with the recycling and reuse industries, economic modeling and management of sizable databases, including experience with the use of automated “merge-purge” algorithms.

***Opportunities should be sought to institutionalize the study as a regularly updated program.***

Ideally, the national study will be repeated periodically to provide trend information. After the study has been implemented, an evaluation should be conducted to seek opportunities to institutionalize the study over time. This may require revising the recommended methodology. One option for consideration is the potential to license an existing recycling database owner to expand and maintain the centralized database, with the agreement that the database be made available to replicate the study periodically. The potential to fund the study through such licensing fees, in combination with sales of the final report should also be investigated.

### **3.6. Estimated Time line and Costs to Implement the Methodology**

#### ***Estimated Time Line***

NERC recommends a two-phase strategy for implementing the recommended methodology. In Phase One, the methodology is implemented and refined in the ten Northeastern states. In Phase Two, the study is extended to the remainder of the nation. The following time line presents one plausible scenario for implementing the two phases.

***One Plausible Time Line for Implementing the Recommended Methodology***

<u>Target Date</u>	<u>Phase One Milestones</u>	<u>Phase Two Milestones</u>
Month One	RFP Issued.	
Month Two	Contractor Secured.	
Month Four	Existing information evaluated. Database of businesses complete. Overall data collection program designed. Survey forms designed and tested.	RFP Issued.
Month Five		Contractor Selected.
Month Seven	Surveys complete.	
Month Eight	Extrapolation and Data Gaps Filled. Economic Models Applied.	Database of businesses complete. Survey design complete.
Month Nine	Final Report.	
Month Twelve		Surveys complete.
Month Fourteen		Data extrapolation and gaps complete.
Month Fifteen		Final Report.

***Estimated Implementation Costs***

Estimating the total cost of implementing the recommended methodology is complicated by uncertainty over the cost and feasibility of obtaining existing data and coordinating with existing survey programs, and by the uncertainty over the need for additional intermediate input data required to apply economic models. Consideration of the costs of completed recycling economic information studies provides only limited guidance, since they used different approaches, were implemented by various combinations of contractors and government staff and varied in terms of the scope of work undertaken. Some studies, such as those conducted in Washington and Florida, were implemented entirely by government staff. Other studies, such as those conducted for Arizona and Iowa, relied more heavily on consultants. Consultant costs ranged from a low of zero to a high of \$100,000. Although no cost estimates were available, all studies required a significant amount of staff time to manage the contracts and assist in data collection.

NERC estimates that the consultant costs for implementing the methodology will be approximately \$105,000 for Phase One, and approximately \$155,000 - \$200,000 for phase two. (These costs do not include the resources required to cover staffing by an independent organization to oversee and assist in the study.) These estimates are based on the following assumptions:

1. Phase One is assumed to cover the ten Northeastern states, with Phase Two covering the remainder of the nation.
2. The use of existing information is assumed to be determined to be appropriate for the business categories listed in Tasks One and Five.

3. A total survey frame is conservatively assumed at approximately 4,000 businesses in Phase One, and 8,000 businesses in Phase Two. And, most sources for compiling a central database have already been compiled in hard copy or electronic form by the Northeast Recycling Council.

4. Additional intermediate input data is required to be compiled for approximately 8 business categories, and detailed interviews with 3-5 businesses are used to compile the data for each business category.

5. Activities undertaken in Phase One are assumed to significantly reduce the cost of Phase Two by:

- confirming which existing data sources and survey programs are appropriate for use in the study;
- testing and finalizing survey forms for use in the national study;
- developing a standardized approach to extrapolating based on survey results and otherwise filling gaps in the data;
- evaluating the need for new “intermediate input data” required to apply economic models to the recycling and reuse industries and obtaining these data where necessary; and
- confirming the process for applying economic models to the recycling and reuse industries.
- These costs estimates are for consulting services only, and do not include the costs of an appropriate organization to coordinate the study and manage the consultant, such as the Northeast Recycling Council or the National Recycling Coalition.

Should the study be replicated in future years, the costs will likely be significantly less, since much of the cost of the recommended study is for one-time development and refinements in the approach to be used.

### 3.7. Additional Recommendations

This section presents several additional recommendations which were identified during the Recycling Economic Information Project. The recommendations are directed to government and private sector organizations and are intended to enhance the quality and availability of economic information on the recycling and reuse industries.

#### *Federal Agencies*

Several federal data collection programs could be adapted to greatly increase the availability of information on the recycling and reuse industries. Following are several specific recommendations:

- The Census Bureau should evaluate the potential to provide regularly published economic information on recycling manufacturers by adding questions and adjusting the survey design used in the *Annual Survey of Manufacturers*.
- The Census Bureau should add questions on the use of recycled materials, waste generation, recycling, costs of disposal and costs of recycling, and investments in waste prevention to the *Economic Census*, which is conducted every five years, beginning with the 2002 Census.
- The Census Bureau should expand the number of regularly published *Current Commodity Reports* to include more recyclables.
- The Census Bureau should consider adding additional secondary materials and/or used products to those covered in import and export statistics.
- The new *North American Industry Classification System*, to be implemented over the next several years, should be revised to include appropriate categories for recycling and reuse businesses which are not clearly defined in the existing SIC system.
- The United States Geological Survey should expand the types of materials covered in their *Mineral Commodity Surveys* to include information on the consumption of recyclable materials beyond metals.
- The Environmental Protection Agency and the Federal Environmental Executive should encourage and support implementation of the above recommendations.
- The Environmental Protection Agency should fund a staff position at the Department of Commerce, and provide additional resources, to ensure that economic information on the recycling and reuse industries is regularly updated.
- The Environmental Protection Agency should revise the industry definitions and methodology presented in this report, based on the lessons learned after a national study is completed. The resulting definitions and methodology should then be promoted as a

standard to be used in any recycling or reuse economic information study.

### ***Private Organizations***

Financial reporting agencies such as Dunn & Bradstreet, American Business Systems, and Robert Morris Associates maintain databases containing establishment-specific financial data. Because these organizations typically report the data in aggregate form using the SIC system, its utility to the recycling and reuse industries is minimal. By contracting with these organizations, and using the database of recycling and reuse establishments to be compiled in the proposed study, several useful reports could be compiled.

- Robert Morris Agency could compile a separate listing of aggregated financial data in their *Annual Statement Studies* for recycling businesses with no identifiable SIC code, and/or separate data on firms within SIC categories which are recyclers or reusers.
- Other financial reporting agencies could provide aggregated averages on financial performance, including loan defaults, average financial statistics and amount and sources of capital.
- Recycling market development officials should launch a campaign to clarify appropriate assignments using the new North American Industrial Classification System (NAIC), and to ensure that recycling businesses are appropriately classified.

## 4. JUSTIFICATION FOR THE TYPES OF INFORMATION TO BE OBTAINED

### 4.1. Overview of Information Priorities

This chapter provides justification for the recommended priorities for the types of economic information to seek through the methodology. NERC concluded that, while all economic information is useful, the priorities for a study of the U.S. recycling and reuse industries should be as follows:

***First Priority — Obtain for each category of business the data necessary to document industry size: number of firms, total tonnage recovered by material, total employment, total wages, total sales and value added.***

These data were identified as most useful in a survey of potential study users (see Appendix D); they are the data types most often obtained in previous recycling economic studies; they are the direct data types required to apply economic models to estimate total economic impacts; and they can feasibly be obtained through the recommended methodology.

***Second Priority — Obtain the data required to calculate total economic impacts in a standardized manner at the local and regional level, and provide guidance on applying models.***

Economic impact information ranked high in the survey of potential study users and was obtained in several previous studies. Vastly different assumptions were used in applying models in previous studies, exposing a significant need for standardization and guidance. Since much of the data required to apply models is listed as top priority information, models may be applied relatively efficiently. The additional information to be obtained includes “intermediate input” data for those recycling and reuse business categories which do not correspond in a direct manner to SIC categories. Once this data is obtained, appropriate economic models can be applied to a small number of case-study regions to obtain the following information:

- Estimates, for each industry category, of total impacts, including direct, indirect and induced employment, wages, sales, value added and (depending on the model employed) local, state & federal tax revenue.
- Estimates of economic impacts associated with several categories of support businesses, including brokers, equipment dealers, consultants and engineers, and others.
- Estimated *multipliers* for each industry category. (The ratio of total impacts to direct impacts.)
- Intermediate input data and standards for conducting economic impact analyses of recycling businesses at the state and local levels.

This information will equip recycling market development officials to efficiently calculate the total economic impacts associated with one or more particular recycling facilities. Also, this information can be obtained without adding to the burden on survey respondents or other sources, and consequently complements strategies to obtain the top priority information.

***Third Priority — Obtain other economic information wherever possible.***

Because collecting economic data is expensive, it is necessary to narrowly limit the top priorities for information gathering. However, a survey of potential study users found that every category of economic information has importance to a variety of users. (See Appendix D.) Examples of opportunities to collect additional information include compiling data beyond the top priority types where it is available, and including additional questions in survey forms when this will not to compromise the potential for securing an adequate response rate.

The remaining sections of this chapter further document the central justifications for the above priorities. Section 4.2 summarizes the types of information obtained in past recycling economic information studies, Section 4.3 summarizes the results of a survey of potential study users and Section 4.4 clarifies the recommended information priorities.

## **4.2. Information Obtained in Past Studies**

NERC identified and reviewed ten previous recycling economic information studies conducted at the state or multi-state level. (The studies are listed in Appendix B.) Each study obtained information on several categories of recycling businesses in a state or region. The studies used a wide variety of definitions for both the industry and types of data obtained, and used vastly different methods to obtain the data. The primary purpose of the studies was most often to enhance understanding of the industries and to argue for sustained support from government decision makers. Some states also focused attention on the strategic planning uses of the information.

Most studies sought to obtain a small number of data types indicative of industry size and economic impact, including employment (all 10 studies), value added (seven studies), wages (four studies) and gross sales or revenues (three studies). Another common data type included in the studies was the tonnage of recyclable materials collected (five studies). Other types of information obtained include indirect and induced impacts estimated through use of an input-output model (three studies) and capital investment (three studies). Two studies estimated tax revenue benefits accruing to local and state governments, and one study surveyed recycling businesses on a wide range of business development issues.

The recommended information priorities are consistent with the priorities used in many previous studies. The range of information to be collected is somewhat narrower than for several of the studies. This is to reduce the cost of a national study, and to reduce the complexity of survey forms, thereby contributing to maximizing response rates.

## **4.3. Summary of a Survey of Potential Study Users**

To assist in establishing priorities for collecting recycling economic information, a survey was sent to approximately 350 recycling officials, economic developers and private sector professionals with an interest in recycling. Sixty-eight surveys were returned, with 31 responses from economic developers, 19 responses from private sector organizations (four venture capitalists, four bankers, two other financial, three recycling business representatives and six consultants) and 18 responses from government recycling officials. The complete survey results and the survey form are presented in Appendix C.

Respondents were asked first to identify the three *categories* of information which would be most useful to them. Then, for each of the categories selected, they were asked to identify the three most useful *data types*. While not designed to be statistically representative, this informal survey provides insight into the information needs of the three respondent groups. The results provide indications of the relative utility of various types of information, and should be considered in determining priorities for a study of the U.S. recycling industry.

The survey results indicate that all of the broad categories and specific data types listed in the survey have some degree of utility to the respondents. However, two categories emerge as top priorities: industry size and market information. Similarly, within each broad category, a small number of specific data types emerge as top priorities, although most all data types listed are identified as useful.

*Industry size* and *market information* were tied as the most useful categories of information, with 65% of the respondents identifying each of these as a top priority. These were followed *facility-specific information* (57%), *investment information* (44%), *net benefits* (37%) and *financial performance* (26%). Only 6% of respondents identified the category of *comparisons to other industries* as a top priority. Private sector respondents showed a less pronounced preference for any single category of information than other groups. Recycling officials showed most preference for market information, while economic developers identified industry size as the most useful category. The survey results are summarized in Table 4.1

**Table 4.1 Results of Data Users Survey**

<b>Category of Information (In order of priority)</b>	<b>Top Priority Data Types</b>	<b>Second Priority Data Types</b>
1. <i>Industry Size</i>	- employment - annual sales	- number of firms - total impacts from I/O model - annual production - annual wages - value-added - exports value/volume
2. <i>Market Information</i>	- domestic demand - recycled material prices - summary of factors influencing demand - supply data	- recycled product prices - production capacity - recycled material export/import trends

Category of Information (In order of priority)	Top Priority Data Types	Second Priority Data Types
		- recycled material inventories - recycled product export trends
3. <i>Facility-Specific Information</i>	- average statistics for particular types of firms, especially employment and wage statistics - detailed case studies of specific business development projects	
4. <i>Net Economic Benefits</i>	- net employment - net tax revenue generation - net value added	
5. <i>Investment Information</i>	- planned expansions and investments - industry structure - summary of growth drivers	- sources of capital - annual capital investment - uses of capital - mergers and acquisitions summary
6. <i>Financial Performance Information</i>	- average investment performance - financial ratios - financial statistics	- number of loan defaults - average debt/equity - number of bankruptcies - stock values of public co.s
7. <i>Comparisons to other industries</i>	These industries were most often identified: - virgin resource extraction - all manufacturing - landfill/incineration - utilities	

#### 4.4 Definitions of Value Added and Other Data Types

In general, it is recommended that wherever possible, standardized definitions used by the U.S. Department of Commerce, Bureau of Census be used. To the extent feasible, data should be gathered only on the recycling and reuse activities covered, and not on other, non-recycling activities which may occur at a particular site. However, this may not always be feasible and, when necessary, the study implementors will need to develop policies for either allocating the percentage of recycling activity occurring, or reporting activities which include some non-recycling activities and documenting this accordingly.

Defining value added for recycling and reuse businesses is a subject of some controversy. While the basic definition of value added is no different than for other industries<sup>1</sup>, previous studies have

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<sup>1</sup> Value added is typically defined as the amount of income and wealth generated in the industrial processes associated with each stage of production of a particular commodity. A simple measure of value-added, used by the U.S. Census Bureau, is the gross output of a firm (as measured by sales, gross receipts, and other operating income plus inventory change) minus intermediate inputs (the consumption of other goods and services that are purchased from other industries). See Appendix E for additional information.

made conflicting arguments over which industry segments should be included in the calculation. The controversy centers on whether and how to account for tradeoffs with other industries, such as waste disposal and virgin materials extraction; and how to define the economic impacts of the recycling and reuse industries. Some have argued that to truly measure the “economic impacts of recycling,” tradeoffs such as jobs lost in disposal operations or virgin materials extraction must be factored in. This is extremely complex due to the market dynamics inherent in recycling and materials extraction and manufacturing industries. One approach often taken is to limit measurement of recycling impacts to economic activities undertaken by processors alone. This approach was used, in varying degrees, by studies in Minnesota, Iowa, the Northeast and Southeast states, and is supported by arguments that recycling collection jobs are to some degree supplanting garbage disposal jobs, and that recycling manufacturing jobs would exist regardless of whether the manufacturing were using recycled materials or not.

At least one study, undertaken for Arizona, defined recycling economic impacts much more broadly, arguing that not only should collection activities be counted, but disposal costs avoided through recovery of materials should also be counted as “value added.” Recycling market developers, usually focused on developing manufacturing capacity for recovered materials, have also asserted that manufacturing activities should be counted.

NERC recommends the middle ground approach adopted in the Iowa study, whereby impacts are measured at both the processing and manufacturing levels, but reported separately with appropriate caveats. These issues are discussed in more detail in Appendix E.



## 5. JUSTIFICATION FOR THE TYPES OF RECYCLING AND REUSE BUSINESSES COVERED IN THE STUDY

### 5.1. Overview of the Business Categories Included

This chapter provides justification for the types of recycling and reuse businesses covered in NERC's recommended information gathering methodology. Table 5.1 lists the recycling and reuse business categories NERC identified. Detailed descriptions for each category are provided in Appendix A. The list of business categories presented in Table 5.1 is intended to include all businesses which undertake the recycling and reuse economic activities defined later in this chapter. The categories are not intended to be definitive and should be refined during implementation of the recommended study. In particular, additional research is recommended to better define reuse business categories. Note that to reduce costs the recommended data collection methodology presented in Chapter 3 does not target the "recycling collection" segment for extensive analysis. This is consistent with goal of focusing on value adding economic activities.

**Table 5.1 List of Recycling and Reuse Business Establishments Included in the Recommended Methodology** (\* indicates limited data will be obtained)

#### **Recycling Collection**

- \*Government-staffed collection programs
- \*Hauler-based collection
- \*Disposal facility-based collection
- \*Commercial facility-based collection
- \*Manufacturing and industrial facility-based collection

#### **Recycling Processing and Manufacturing**

- Recyclable material wholesalers
- Materials recovery facilities
- Construction & demolition debris processors
- Deinked market pulp producers
- Paper and paper board mills
- Other paper product producers
- Beneficiation facilities
- Glass container manufacturing plants
- Fiberglass insulation producers
- Other recycled glass product producers
- Detinning facilities
- Steel mills
- Iron and steel foundries
- Smelting and refining mills
- Nonferrous extruded product producers
- Nonferrous foundries
- Plastics reclaimers
- Plastics converters
- Crumb rubber producers
- Miscellaneous rubber product manufacturers

#### **Recycling Processing and Manufacturing (Con't.)**

- Compost producers

- Miscellaneous organics product producers
- Aggregate and pavement mix producers
- Textile processors
- Used oil refiners (not for fuel)
- Household hazardous waste processors (for recycling only)
- Other recycling processors and manufacturers

#### **Wholesale Reuse**

- Tire retreaders
- Electronic appliance demanufacturers
- Wood reuse
- Materials exchange services
- Motor vehicle parts
- \*Equipment remanufacturers
- Miscellaneous used merchandise sales (wholesale)

#### **Retail Reuse**

- Miscellaneous used merchandise sales (retail)
- Repair and used product shops

#### **Support Businesses**

- Recycling and reuse equipment manufacturers
- \*Consulting and engineering services
- \*Brokers
- \*Transporters

The remaining sections of this chapter offer justification for this list of business categories. Section 5.2 reviews the types of businesses included in previous recycling economic impact studies. Section 5.3 defines the economic activities which should be counted as part of the recycling and reuse industries for the purposes of conducting an economic study. Section 5.4 discusses the challenge and approach taken to draw consistent boundaries for each industry segment. Finally, section 5.5 discusses the types of scrap materials and used products intended to be included in the study.

## **5.2. Business Categories Included in Past Studies**

The ten state and multi-state recycling economic information studies reviewed (and listed in Appendix B) used a range of definitions for the recycling industry. The business categories covered in the ten studies included manufacturers and processors handling recovered paper, glass, metals, plastic and organics (all ten studies), private and/or public sector recycling collectors (seven studies), brokers (four studies) equipment dealers (two studies), transporters (one study), education groups (one study) and retailers specializing in recycled products (one study). Only one study, prepared for North Carolina, included any reuse businesses (laser cartridge remanufacturing, metal drum and building materials reuse.)

The business categories listed in Table 5.1 is somewhat broader than those included in most previous recycling economic information studies, since many did not attempt to include reuse and restricted their recycling focus to paper, metal, glass, plastic and organics. The list is somewhat narrower than a few previous studies which included non-profit and government advocates or education programs, which are not included in Table 5.1.

## **5.3. Definition of Recycling and Reuse Activities**

For the purpose of documenting economic information, “Recycling and Reuse” is defined in this report to include the activities listed below.

- a) collecting scrap materials and used products for the purposes of intermediate processing, processing, manufacturing and/or distribution by reuse sales establishments;
- b) intermediate processing of scrap materials and used products including sorting, cleaning, consolidating, treating, disassembling, densifying and/or transferring ownership for use in processing, product manufacturing and/or for distribution by reuse sales establishments;
- c) processing of scrap materials and used products to produce refined raw materials and/or reusable products meeting the specifications of manufacturers, reuse sales establishments or other end-users;
- d) manufacturing first-stage<sup>2</sup> products containing scrap materials or used products;

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<sup>2</sup> The term “first stage product” in this report refers to the first product produced from recycled materials, such as a roll of paper, sheet of plastic, glass bottle or metal billet. First stage products are often converted into final stage

- e) operating wholesale or retail sales establishments that offer, largely or exclusively, used products prepared for reuse; and
- f) directly supporting the above activities through research, equipment development and sales, consulting, engineering, brokering and exchange services.

#### **5.4 Drawing Consistent Boundaries for Each Material and Product Type**

In considering which activities to include, the project team sought to draw consistent, appropriate boundaries around the industries by:

- including those activities which are most essential to the continued recycling or reuse of scrap materials and used products;
- including all “supply side” activities involved in recovering and preparing scrap materials and used products for resale;
- including “demand side” activities up to the first point at which the scrap materials or used products have successfully competed directly against their respective primary, or *virgin* equivalents;
- including only those “direct support” activities which require specialized knowledge or functions making them essential to recycling or reuse;
- excluding the activities of non-business entities such as individuals, and of advocacy, education and other organizations which do not directly add value to scrap materials and used products, or directly support such activities; and
- excluding activities involving incineration or use of materials as fuel.

Determining the boundaries of the industry for each material or product type was challenging, and will require further refinement during implementation of the methodology. The most significant challenge was defining the end-point of activities to include. Clearly, businesses throughout the supply chain are essential to the recycling market place. However, targeting all these businesses would be complex since recycled and non recycled products are often mixed and not readily identified during distribution, and would unduly exaggarate the scope of the recycling industry. Consequently, the project team defined the first stage manufactured product as the appropriate end-point for the study. At this stage, the scrap material has been converted into a product which is comparable to a product produced from primary materials. This is consistent with several of the previously completed recycling economic impact studies. In practice, using this definition will

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products (e.g., envelopes, plastic bottles or metal parts), sometimes at the same facility. Only production of first stage products is intended to be included in this definition.

be challenging. For some material types, many different economic activities may occur in a single facility, only some of which satisfy the definitions for recycling and reuse. In these cases, an effort should be made to segregate and document separately the activities covered from those not covered. Where this is not possible, the study implementors may need to characterize activities not intended to be included, and carefully document this when reporting results.

### 5.5. Scrap Materials and Used Products Included

Businesses involved in any of the activities described in Section 5.2 handling all nonhazardous scrap materials and used products generated by residences, businesses, institutions and industrial establishments are intended to be defined as recycling and reuse businesses. Table 5.2 lists several specific types of scrap materials and used products to be included. In considering which materials and products to include, the project team sought to:

- include those that, if not recycled or reused, would generally be disposed in Subtitle D landfills or incinerators;
- include those known to be fueling new economic activity among recycling and reuse establishments;
- exclude those that are typically handled on-site by industrial facilities; and
- exclude those which are regulated as hazardous or toxic wastes, unless they are commonly mixed with subtitle D wastes in disposal or recycling activities.

The list in Table 5.2 was developed by evaluating against the above criteria each type of waste material and product category included in EPA’s definition of “subtitle D waste.” Subtitle D wastes are those which may be disposed in Subtitle D solid waste facilities (generally all nonhazardous solid waste materials). The list includes all materials and products included in EPA’s *Characterization of Municipal Solid Wastes in the U.S.* series, a national benchmark for measuring recycling activity. Note that Table 5.2 is not intended to be comprehensive, but only provide examples of the materials included. Note that materials typically considered “preconsumer,” are included, as well as those considered “post-consumer”; only materials handled on-site were excluded from the definition. Materials and products excluded from the definition include mining wastes, agricultural and industrial wastes typically handled on-site (e.g., farm animal wastes, solvents), and hazardous and toxic wastes which never enter Subtitle D landfills. It also should be noted that, although EPA’s reports and regulations concerning solid waste have been used to help identify the scrap materials and used products covered in this report, these materials and products are in fact valuable, marketable commodities.

**Table 5.2. Examples of Scrap Materials and Used Products Included**

Scrap Materials	Used Products
paper and paper board	used pallets

glass ferrous metals auto bodies aluminum other nonferrous metals plastics rubber and leather textiles wood food wastes yard trimmings other organic wastes construction & demolition debris household hazardous waste paper mill sludge	used electronic appliances used clothing used equipment used packaging materials used furniture laser toner cartridges
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## **6. JUSTIFICATION FOR THE RECOMMENDED APPROACHES TO OBTAIN ECONOMIC INFORMATION**

### **6.1. Overview**

This chapter evaluates alternative approaches for obtaining economic information to publish in a study of the U.S. recycling and reuse industries, and provides justification for NERC's recommended methodology presented in Chapter 3. NERC undertook two main steps to develop the recommended methodology. First, we reviewed the potential for existing government and private sector programs to provide the information being sought. This review is summarized in Appendix B, along with contact and reference information for each source. Secondly, based on this review, we evaluated the potential to use each of the five broadly defined information gathering strategies to obtain the desired information:

- republishing data obtained from existing information sources;
- coordinating with existing survey programs;
- developing a database of business establishments and conducting a new survey;
- using desk-top extrapolation techniques; and
- using economic models.

Sections 6.2 through 6.6 evaluate these options. Section 6.7 summarizes the evaluation for each of the 45 recycling and reuse business categories identified in Chapter 5, including recommended strategies.

### **6.2. Republishing Data Obtained from Existing Information Sources**

Obtaining economic information from existing sources is the preferred option, provided the data is of sufficient quality and consistent in definition with other data collected for the study, and that appropriate agreements can be made with the source regarding republication of the data.

The advantages of using existing data are obvious — it can save considerable time and resources compared to obtaining information through other means. The disadvantages may include inconsistent definitions for data and time periods covered, variable or unknown accuracy, difficulty in securing agreements to republish data and real or perceived conflict of interest with the data provider. Unfortunately, only a small number of sources can currently provide economic information on the recycling and reuse industries, and most provide only very limited data on only one particular industry segment. Many sources obtain data from recycling and reuse businesses, but then aggregate the data using SIC categories which also include non-recycling businesses. Appendix B broadly reviews existing sources of information, and Section 6.7 lists sources for each business category.

### **6.3. Coordinating with Existing Survey Programs**

Where no information source exists, the next-best option may be to coordinate with an existing survey program to obtain economic information. Under special arrangement, such survey programs could add questions or make other adjustments to obtain economic data on many segments of the recycling and reuse industries.

Compared with conducting new, stand-alone surveys, the advantages of coordinating with existing survey programs include reduced implementation time and cost, reduced burden on survey respondents and possibly higher numbers of survey responses. Potential disadvantages include real or perceived conflicts of interest between the surveying organization and the study sponsors, and the possibility of inconsistent survey designs among different data collection approaches combined under the banner of a single study. Many programs exist which regularly survey particular segments of the recycling and reuse industries. The programs are operated by government agencies, trade associations, for-profit data companies and non-profit advocacy organizations. Section 6.7 lists the survey programs targeting each business category.

#### **6.4. Developing a Database of Business Establishments and Conducting New Surveys**

If sources of data do not exist, and it is not feasible to coordinate with existing survey programs, then the next-best option may be to develop a database of business establishments and conduct a new survey.

The advantages of a new survey include the ability to design and implement the survey using consistent guidelines, to request the information most needed by study sponsors, and to obtain primary data not available through any other means. The main disadvantages of conducting a new survey are the high cost and time required to develop a database, achieve an adequate response rate, obtain the information requested and to extrapolate results to the entire universe of firms. These disadvantages are discussed further below.

*Developing a database* — Developing a database can be difficult because the recycling and reuse industries contain tens of thousands of business establishments, with no single source for identifying firms. (Appendix C lists potential sources for compiling a database of recycling and reuse business establishments.) Many of the best existing databases of business establishments are proprietary, and may not be available to study sponsors. Some database managers have indicated they would only provide mailing labels or conduct a survey under contract, but would not provide direct access to their electronic database. This complicates the task since compiling a comprehensive database of recycling and reuse firms ideally would involve piecing together many different sources and eliminating duplicates, and this process requires that the databases used be combined in electronic form into a single file.

*Achieving an adequate response rate* — The authors of past recycling studies agree that achieving a significant survey response rate requires multiple contacts — generally an initial mailing followed by at least one phone call. Furthermore, some industry segments may be particularly reluctant to participate in surveys. Some federal and state survey programs require participation by law. Some companies have policies of not participating in voluntary surveys.

*Obtaining the desired information* — Experienced survey designers uniformly caution that surveys should be as simple and short as possible. In general, survey response rates are reduced significantly by requests for information deemed sensitive (e.g., financial performance statistics), information which requires the respondent to conduct research or perform calculations (e.g., estimating recycling-specific statistics for a facility that includes both recycling and non-recycling activities), information which may not be clear and understandable to the respondent, or requests for too much information.

*Extrapolation techniques* — Because it is generally impossible to achieve a 100% response rate, appropriate extrapolation techniques are necessary to derive data estimates for the total population of identified business establishments. Techniques used in past recycling economic studies include extrapolating based on average figures per ton of material handled, per employee or per business establishment. Extrapolation can be complicated by the significant variation in size of business establishments within many industry categories. No recycling-specific research was identified which evaluates the various extrapolation techniques. At least one study, prepared for the state of Washington, chose not to extrapolate at all and conservatively reported only the data provided in survey responses.

Despite these disadvantages, the dearth of alternatives makes surveys the most common means of obtaining economic information on recycling businesses, and all recycling economic impact studies performed to date have relied on them to some extent. The feasibility of conducting new surveys largely depends on the ability to identify businesses and construct a reasonably comprehensive database.

## **6.5. Using Desk-Top Extrapolation Techniques**

Where no other feasible option exists for obtaining direct economic information, estimates can often be derived through desk-top extrapolation techniques. This is similar to the extrapolation process used in surveys (discussed above) whereby the results obtained from survey respondents are allow estimates regarding the entire population of firms in a particular category. The difference is that desk-top extrapolations are not based on data obtained in new surveys, but on more limited secondary data available through existing sources.

The advantages of using desk-top extrapolation techniques are the very low cost and the possibility of deriving a wide range of statistics. The primary disadvantage is the poor quality and credibility of the resulting estimates. This is a significant disadvantage, since in many cases it will be impossible to determine the level of accuracy of the derived estimates, and consequently the credibility of all data published in a study may suffer. Desk-top techniques area not recommended in this study, except for the recycling collection industry segment, which has been given secondary priority in order to reduce overall study costs and to focus primary data collection on value adding industry segments.

## **6.6. Using Economic Models**

Once *direct* economic impacts are estimated through one of the approaches described above,

economic models can be used to estimate *indirect* and *induced* impacts. Direct economic impacts refer to the specific business activity being studied, for example, the number of people employed by compost production facilities. Indirect impacts accrue due to suppliers and customers (e.g., the number of people employed by equipment and business accounting firms used by the compost production facility) and induced impacts accrue due to the purchasing of employees (e.g., the number of people employed at retail stores and restaurants as a result of the compost facilities' employees' purchases). The ratio of total impacts (direct + indirect + induced) divided by direct impacts is sometimes referred to as a *multiplier*. The economic impacts covered usually include employment, wages, sales, value-added and sometimes tax revenue accruing to local, state and federal government agencies. (See Section 4.5 for a discussion of how to use economic models to calculate value added.)

The most common type of model used in economic impact analyses is based on an input-output approach developed by the U.S. Bureau of Economic Analysis. Versions of this approach include *RIMS II*, *IMPLAN* and a more complex version which incorporates other modeling techniques, *REMI*. The basis for these models are average statistics on the amount of money spent by a particular type of industry on various *intermediate inputs* (e.g., purchases such as chemicals, accounting services and equipment which are necessary for production), per \$1,000 in sales, and the percentage of these purchases which occur within the study region. Thus, the economic input-output model describes the *economic linkages* between suppliers and customers in a region.

The main advantage of using economic models in a study of the recycling and reuse industries is that estimates of total impacts (including indirect and induced impacts) can be derived. Also, estimates of certain "support" industries' contribution to recycling or reuse may be obtained, as can average, total multipliers for various industry categories.

The primary disadvantage of using input-output models for the recycling and reuse industries are the lack of average statistics on intermediate inputs used by many industry categories. Data on intermediate inputs typically used in economic input-output models, like other economic data, are available only for certain industries defined by SIC code. Thus, it is difficult to apply input-output models to the many recycling and reuse industry categories which do not fit neatly into an existing SIC category. Furthermore, even for recycling and reuse industries which do fit into specific SIC categories, as does paper manufacturing, there is no certainty that the existing model data, compiled by the Federal Bureau of Economic Analysis for both recycling and non-recycling businesses in the SIC category, are accurate.

Where intermediate input data are available, it can be obtained by surveying recycling and reuse businesses. A limited version of this approach was used for a study executed for the Iowa Department of Environmental Protection. Another approach is to use intermediate input data from an existing SIC category which approximates the recycling category under study. This approach was used by studies performed for the Minnesota Department of Natural Resources and the Florida Department of Commerce.

Economic models have been applied in at least three past recycling economic impact studies. Florida used a *RIMS II* model and Iowa used the *IMPLAN* model, both based on the approach

developed by the federal Bureau of Economic Analysis. Minnesota used REMI, a similar, private-sector model which combines the typical input-output approach with other economic modeling techniques.

NERC recommends evaluating each category of recycling and reuse business to determine if existing intermediate input data is acceptable, and developing new data where necessary.

### **6.7. Evaluation of Information Gathering Options for each Business Category**

Table 6.1 identifies and evaluates the options for obtaining information on each business category, including existing sources and survey programs, the feasibility of developing a database and conducting new surveys and the availability of the “intermediate input” data required to apply economic models. Also included in the table is a synopsis of the recommended information gathering approach for each business category. The approximate number of establishments in each category is also listed in Table 6.1. This was determined based on information in existing databases listed in Appendix C, Census Bureau data on SIC codes, and discussions with industry experts.

**Table 6.1 Approaches for Obtaining Economic Information on Each Business Category**

Business Category (Est. # businesses)	Existing information sources and survey programs (See Appendix B for contact info.)	Feasibility of developing a database of establishments and conducting a survey (See Appendix C for contact info.)	Recommended information gathering approaches
<p>Government-staffed collection programs</p> <p>Hauler-Based Collection</p> <p>(12,000 Municipal programs; undetermined # hauler-based recycling programs)</p>	<ul style="list-style-type: none"> <li>• State Recycling Programs (number of municipal programs, annual tons collected by material, annual surveys)</li> <li>• BioCycle Magazine (number of municipal programs by type)</li> <li>• Steel Recycling Institute (number and type of programs, materials handled, periodic survey survey to update contact information)</li> <li>• American Plastics Council (number and type of programs, tons plastic recovered, collection costs, annual survey)</li> <li>• U.S. EPA (tons recovered by material)</li> <li>• Environmental Business International (estimated value of recovered tons by material)</li> </ul>	<p>Feasible at very high cost due to number of programs and need to avoid double counting between government staffed and privately staffed municipal recycling programs. Most comprehensive single list may be the Steel Recycling Institute's.</p> <p>A limited survey of large waste hauling establishments could capture a significant percentage of overall activity.</p>	<ul style="list-style-type: none"> <li>• Compile existing information.</li> <li>• Conduct a limited survey of large waste haulers to estimate recycling activities.</li> </ul>
<p>Disposal Facility-Based Collection</p>	<ul style="list-style-type: none"> <li>• Governmental Advisory Associates (tons recovered at waste-to-energy facilities, annual survey)</li> <li>• Chartwell Information Systems (monthly survey of landfills)</li> </ul>	<p>Feasible. Lists available through Chartwell, EPA, state agencies.</p>	<ul style="list-style-type: none"> <li>• Limit effort to compilation of existing information.</li> </ul>
<p>Commercial Facility-Based Collection</p>	<ul style="list-style-type: none"> <li>• State Recycling Programs (number of redemption/ deposit centers in stores)</li> <li>• Rechargeable Battery Recycling Corporation (# of retail collection programs, tons and number of</li> </ul>	<p>Not feasible. Identifying establishments may be impossible. Requesting separate data on recycling activities may be unreasonable.</p>	<ul style="list-style-type: none"> <li>• Limit effort to compilation of all existing information.</li> </ul>

<b>Business Category (Est. # businesses)</b>	<b>Existing information sources and survey programs (See Appendix B for contact info.)</b>	<b>Feasibility of developing a database of establishments and conducting a survey (See Appendix C for contact info.)</b>	<b>Recommended information gathering approaches</b>
	batteries recycled)		
Manufacturing and Industrial Facility-Based Collection	<ul style="list-style-type: none"> <li>Bureau of Economic Analysis (limited data on tons shipped between industry categories)</li> </ul>	Not feasible except possibly by adding questions to the next economic census in 2002. The survey would need to cover all commercial and industrial business categories.	<ul style="list-style-type: none"> <li>Evaluate data on tonnage and number of businesses, as available through BEA.</li> <li>Evaluate potential to estimate tonnage by subtracting residential tonnages (from states) from total U.S. recovery (from EPA).</li> </ul>
Recyclable Material Wholesalers (10,000)	<ul style="list-style-type: none"> <li>U.S. Census Bureau for SIC 5093, Scrap and Waste Materials (employment, wages, number of firms, sales)</li> <li>State recycling programs (limited data on tons recovered)</li> <li>ISRI (tons recovered)</li> <li>Steel Recycling Institute (periodic survey to update contact info)</li> </ul>	Very costly. No single, comprehensive database exists. Best databases may not be available for merge-purge. Best sources are Steel Recycling Institute, American Recycling Markets, Institute of Scrap Recycling Industries.	<ul style="list-style-type: none"> <li>Evaluate use of Census Bureau data for SIC 5093. If necessary, consider conducting a limited sample survey and extrapolating based on per ton figures. (To avoid high cost of compiling a comprehensive database.)</li> </ul>
Materials recovery facilities (450)	Governmental Advisory Associates (wide range of data including all priority information, annual survey)	Feasible. Lists available through states.	<ul style="list-style-type: none"> <li>Evaluate use of data from GAA.</li> <li>If necessary to augment existing information, contract with GAA to adjust future survey or conduct independent survey.</li> </ul>
Construction & Demolition Debris Processors (up to 2,000)	<ul style="list-style-type: none"> <li>None identified.</li> </ul>	Feasible. Lists available through multiple sources.	<ul style="list-style-type: none"> <li>Develop a database of establishments and conduct a survey.</li> <li>Evaluate whether this category should be aggregated with MRFs or Recyclable Material Wholesalers.</li> </ul>
Deinked market pulp producers (less than 20)	May be covered in Miller-Freeman surveys.	Feasible. Lists available through Recycled Pulp & Paper Coalition, American Forest & Paper Association and others.	<ul style="list-style-type: none"> <li>Evaluate availability of data through Miller Freeman.</li> <li>If not available, develop database and conduct surveys.</li> </ul>

<b>Business Category (Est. # businesses)</b>	<b>Existing information sources and survey programs (See Appendix B for contact info.)</b>	<b>Feasibility of developing a database of establishments and conducting a survey (See Appendix C for contact info.)</b>	<b>Recommended information gathering approaches</b>
Paper and paper board mills (500)	<ul style="list-style-type: none"> <li>• Miller Freeman Publishing (extensive data on companies; may not be available at establishment level)</li> <li>• American Forest &amp; Paper Assoc. (Tons consumed by mill; annual capacity survey)</li> </ul>	Feasible. Lists available through AF&PA, private financial data organizations and/or state recycling organizations.	<ul style="list-style-type: none"> <li>• Evaluate availability of data through Miller Freeman.</li> <li>• If not available, evaluate coordinating with Miller Freeman, AF&amp;PA or Census Bureau surveys.</li> <li>• If coordination not feasible, develop database and conduct surveys.</li> </ul>
Other paper product producers (less than 200)	None identified.	Feasible. Lists available through Molded Fiber Environ. Assoc., Cellulose Insulation Mntfg. Assoc. and State/regional recycling organizations.	<ul style="list-style-type: none"> <li>• Develop database and conduct surveys.</li> </ul>
Glass beneficiation facilities (90)	None identified.	Feasible. List available through Glass Packaging Institute.	<ul style="list-style-type: none"> <li>• Develop database and conduct new survey.</li> <li>• Evaluate aggregating category with Recyclable Material Wholesalers.</li> </ul>
Glass container manufacturers (82)	Glass Packaging Institute (tons scrap glass consumed).	Feasible. List available through Glass Packaging Institute.	<ul style="list-style-type: none"> <li>• Develop database and conduct new survey.</li> </ul>
Fiberglass insulation producers (less than 225)	None identified.	Feasible. List available through private financial data organizations and state/regional recycling organizations.	<ul style="list-style-type: none"> <li>• Develop database and conduct new survey.</li> </ul>
Other recycled glass product producers (undetermined number -- probably less than 100)	None identified.	Feasible. Develop list from multiple sources, especially state/regional recycling org.s.	<ul style="list-style-type: none"> <li>• Develop database and conduct new survey.</li> </ul>
Steel mills Iron and steel foundries (1,800 total)	<ul style="list-style-type: none"> <li>• American Iron &amp; Steel Institute (wide range of data)</li> <li>• Steel Recycling Institute (tons recycled, select economic data)</li> <li>• Census Bureau, Annual Survey of</li> </ul>	Feasible. Lists available through SRI, AISI and other sources.	<ul style="list-style-type: none"> <li>• Evaluate existing information sources. May need to estimate portion of activities at facilities covered under definitions used in this report.</li> <li>• If above infeasible, seek to coordinate with</li> </ul>

<b>Business Category (Est. # businesses)</b>	<b>Existing information sources and survey programs (See Appendix B for contact info.)</b>	<b>Feasibility of developing a database of establishments and conducting a survey (See Appendix C for contact info.)</b>	<b>Recommended information gathering approaches</b>
	Manufacturers (wide range of data) <ul style="list-style-type: none"> <li>• U.S. Geological Survey (Tons consumed, market info)</li> </ul>		<ul style="list-style-type: none"> <li>• existing survey programs.</li> <li>• If infeasible, conduct new survey.</li> </ul>
Smelting and refining mills Nonferrous extruded product producers Nonferrous foundries (2,500 total)	<ul style="list-style-type: none"> <li>• Aluminum Association (tons consumed)</li> <li>• U.S. Geological Survey (Tons consumed, market info)</li> <li>• Census Bureau, Annual Survey of Manufacturers (wide range of data)</li> </ul>	Feasible for most businesses. Lists available through Aluminum Association and private financial data organizations. May be difficult to identify extruders and foundries.	<ul style="list-style-type: none"> <li>• Evaluate potential for using existing data. May need to estimate percentage of activities covered under definitions used in his report.</li> <li>• If data unavailable, seek to coordinate with existing surveys.</li> <li>• If infeasible, conduct new survey.</li> </ul>
Plastics reclaimers (less than 300)	American Plastics Council (annual survey)	Feasible. List available through American Plastics Council.	<ul style="list-style-type: none"> <li>• Coordinate with APC's annual survey.</li> <li>• If infeasible, develop database and conduct new survey.</li> </ul>
Plastics converters (undetermined and variable)	None identified.	Developing a reasonably comprehensive database of converters may not be feasible. An option is to estimate the number of converters based on existing lists and surveys of reclaimers. Conduct sample surveys and extrapolate based on per ton or per facility estimates.	<ul style="list-style-type: none"> <li>• Limited sample survey and extrapolation based on per ton or per facility averages. (Comprehensive database may be impossible.)</li> </ul>
Crumb rubber producers (undetermined -- probably less than 50)	None identified.	Feasible. List available through Scrap Tire Management Council.	<ul style="list-style-type: none"> <li>• Develop database and conduct new survey.</li> </ul>
Misc. rubber product manufacturers (undetermined — probably less than 200)	None identified.	Feasible. List available through the Scrap Tire Management Council.	<ul style="list-style-type: none"> <li>• Develop database and conduct new survey.</li> </ul>
Compost producers (3,500)	State recycling and/or permitting organizations conduct periodic	Feasible. Lists available through state/regional recycling organizations.	<ul style="list-style-type: none"> <li>• Develop database and conduct survey.</li> </ul>

<b>Business Category (Est. # businesses)</b>	<b>Existing information sources and survey programs (See Appendix B for contact info.)</b>	<b>Feasibility of developing a database of establishments and conducting a survey (See Appendix C for contact info.)</b>	<b>Recommended information gathering approaches</b>
	surveys.		
Misc. organic product producers (undetermined — possibly less than 50)	None identified.	Feasible. Develop lists through state/regional recycling organizations. May need to merge with compost producers category.	<ul style="list-style-type: none"> <li>• Develop database and conduct survey.</li> <li>• If only a very small number of establishments are identified, combine with compost producers.</li> </ul>
Aggregate and pavement mix producers (170)	None identified.	Feasible. List available through the Asphalt Recycling and Reclaiming Association.	<ul style="list-style-type: none"> <li>• Develop database and conduct new survey.</li> </ul>
Textile processors (175)	Council for Scrap Textile Recycling (tons, sales, number of businesses, employment, exports)	Feasible. List available through Council for Scrap Textile Recycling.	<ul style="list-style-type: none"> <li>• Evaluate use of existing data.</li> <li>• If necessary, coordinate with CSTR on new survey.</li> <li>• If above infeasible, develop database and conduct new survey.</li> </ul>
Used oil refiners (less than 10)	None identified.	Feasible. List available through Used Oil Recycling Association. (Limit to non fuel uses.)	<ul style="list-style-type: none"> <li>• Develop database and conduct new survey.</li> </ul>
Household hazardous waste processors (100)	None identified.	Feasible. List available through EPA and state/regional recycling organizations.	<ul style="list-style-type: none"> <li>• Develop database and conduct new survey.</li> </ul>
Other recycling processors and manufacturers (undetermined number)	None identified.	Feasible. Develop database from multiple sources.	<ul style="list-style-type: none"> <li>• Develop database and conduct new survey.</li> <li>• Seek to identify establishments from as many sources as possible.</li> </ul>
Tire retreaders (1,300)	Census Bureau. (Employment, no. Firms, wages, sales)	Feasible. Lists available from Tire Retreaders Association.	<ul style="list-style-type: none"> <li>• Use existing data and cross check with Tire Retreaders' Association to confirm accuracy.</li> <li>• If necessary, conduct new survey.</li> </ul>
Electronic appliance demanufacturers	None identified.	Feasible. Lists available through EPA and state/regional recycling organizations.	<ul style="list-style-type: none"> <li>• Develop database and conduct new survey.</li> </ul>

<b>Business Category (Est. # businesses)</b>	<b>Existing information sources and survey programs (See Appendix B for contact info.)</b>	<b>Feasibility of developing a database of establishments and conducting a survey (See Appendix C for contact info.)</b>	<b>Recommended information gathering approaches</b>
(200)			
Wood reuse (undetermined)	Virginia Polytechnic Institute, Center for Forest Product Mrktg. and Mngmt. (For pallets, tons, sales)	Feasible. Develop list from multiple sources.	<ul style="list-style-type: none"> <li>• Evaluate existing information sources.</li> <li>• If necessary, develop database and conduct new survey.</li> </ul>
Materials exchange services (undetermined)	None identified.	Feasible. Develop list from multiple sources.	<ul style="list-style-type: none"> <li>• Develop database and conduct new survey.</li> </ul>
Motor vehicle parts (7,000)	Census Bureau (employment, wages, number of firms, sales)	Not feasible due to large number of businesses.	<ul style="list-style-type: none"> <li>• Use existing data. Document full range of activities included.</li> </ul>
Equipment remanufacture (up to 73,000)	Boston University, Robert Lund (sales, number of firms, employment, wages)	Not feasible due to large number of businesses. Separate surveys for portions of the category are feasible.	<ul style="list-style-type: none"> <li>• Evaluate use of existing data. Consider potential duplication with repair shops listed below. Consider republishing more conservative estimates without extrapolations used in Boston University report, and/or at greater level of detail.</li> </ul>
Other wholesale used merchandise sales (undetermined number)	None identified.	May not be feasible due to lack of lists.	<ul style="list-style-type: none"> <li>• Seek to develop database and conduct survey.</li> </ul>
Misc. used merchandise sales (retail) (22,000)	Census Bureau (employment, wages, number of businesses, sales)	Not feasible due to large number of businesses.	<ul style="list-style-type: none"> <li>• Evaluate and use existing data. Document full range of activities included.</li> </ul>
Repair and used product shops (74,000 — some may be redundant with <i>Equipment Remanufacture,</i>	Census Bureau (employment, wages, number of businesses, sales)	Not feasible due to large number of businesses.	<ul style="list-style-type: none"> <li>• Use existing data, and document full range of activities included.</li> </ul>

<b>Business Category (Est. # businesses)</b>	<b>Existing information sources and survey programs (See Appendix B for contact info.)</b>	<b>Feasibility of developing a database of establishments and conducting a survey (See Appendix C for contact info.)</b>	<b>Recommended information gathering approaches</b>
above)			
Recycling and reuse equipment manufacturers and vendors (1,200)	Environmental Business International (annual survey, sales estimates)	Feasible -- lists available primarily through publications.	<ul style="list-style-type: none"> <li>• Estimate number of businesses through existing lists and evaluate use of existing data from EBI.</li> <li>• Estimate sales, employment and wages by applying economic model in select states.</li> </ul>
Consulting and engineering services (undetermined number)	Environmental Business International (annual survey may include breakdown for recycling industry consulting and engineering)	Feasible.	<ul style="list-style-type: none"> <li>• Evaluate use of existing data from EBI.</li> <li>• Estimate sales, employment and wages by applying economic model in select states.</li> </ul>
Brokers (up to 2,000)	None identified.	Feasible — although no comprehensive list identified.	<ul style="list-style-type: none"> <li>• Estimate number of establishments based on identified lists.</li> <li>• Estimate sales, employment and wages by applying economic model in select states.</li> </ul>
Transporters (undetermined number)	None identified.	Not feasible due to difficulty in identifying businesses.	<ul style="list-style-type: none"> <li>• Estimate sales, employment and wages by applying economic model in select states.</li> </ul>