Section 1
PROJECT OVERVIEW

1.1 Introduction

R. W. Beck, Inc., in conjunction with David Swenson Consulting, was retained by the Iowa Department of Natural Resources (IDNR) to study the economic impacts of recycling on Iowa's economy. Specifically, there were four objectives of the Economic Impacts of Recycling in Iowa Study (Study) including:

- Measure the current economic impacts of recycling activities (collectors, processors, end-users, remanufacturers and reuse establishments, and recycling equipment manufacturers) on Iowa employment, income, and tax revenue;
- Compare the results of the current Study to the results of the Economic Impacts of Recycling Study completed in 2001 (2001 Study);
- Identify specific recyclable material market development opportunities that maximize beneficial economic impacts upon the state of Iowa's economy; and
- Characterize the greenhouse gas savings associated with Iowa's recycling activities.

1.2 Key Definitions

Prior to initiating the Study, the definitions for a set of key terms were agreed upon by the R. W. Beck Project Team and IDNR staff. These definitions provide a baseline for initiating the Study analysis.

1.2.1 Recycling Activities

The following definitions were used for this Study:

Collectors: Establishments which pick-up or transfer materials through curbside recyclable materials collection, drop-off recyclable materials collection, redemption centers, and/or commercial on-site collection. This category may include for-profit organizations, non-profit organizations, local governments, and redemption centers.

Processors: Establishments that bale, crush, pelletize, compost, de-manufacture or otherwise change the form of the recyclable material for sale to an intermediate market or end manufacturer.

This category may include materials recovery facilities, scrap metal dealers, etc.

End-Users: Establishments that use recyclable materials as feedstock in the production of a new product that is placed into the stream of commerce. This category may include paper mills, steel mills, etc. This category does not include companies which generate recycled materials internally and reuse these materials.

Broker: Individuals or establishments that purchase a recyclable commodity, other than an end-user or processor, for the purpose of commodity resale. Both collectors and processors may use brokers to sell recyclable materials to end-users.

Remanufacturing/ Reuse Remanufacturers and reuse establishments include businesses that remanufacture or reuse materials such as: computers and electronic appliances, used motor vehicle parts, tires, (e.g., retreaders), wood (e.g., pallet rebuilders), and other materials such as toner cartridges. This category also includes retailers that sell used merchandise (e.g., thrift stores).

Recycled Equipment Manufacturers: Establishments that manufacture equipment used solely for the purpose of collection and/or processing of recyclable materials for recovery and reuse. These companies are perceived as composing a unique, well-defined niche within the Iowa economy.

1.2.2 Material Types

Commodity material types selected for this Study include paper, plastics, glass, metals, wood, construction and demolition debris, organics, electronics, and tires. The types of materials within each commodity group targeted for this Study included the following:

Paper:

- Old Newspaper (ONP)
- Old Corrugated Containers (OCC)
- High Grade Office Paper
- Other Paper (Other grades and Mixed)

Plastics:

- Polyethylene Terephthalate (#1 – PET)
- High Density Polyethylene (#2 – HDPE)
- Polyvinyl Chloride (#3 – PVC)
- Low Density Polyethylene (#4 – LDPE)
- Polypropylene (#5 – PP)
- Polystyrene (#6 – PS)
- Mixed Plastics (unknown breakdown)

Glass:

Clear (Flint)

Brown (Amber)

Green or Blue

Mixed

Metals:

Steel Cans

Aluminum Cans

Ferrous Non-Container Scrap

Non-Ferrous Non-Container Scrap

Wood:

Wood includes non-yard wood by-products such as pallets, stumps/tree trunks, sawdust, sawmill scrap, and manufacturing scrap.

Construction & Demolition (C&D):

Asphalt

Concrete

Drywall

Carpet

Carpet Pad

Asphalt Shingles

Organics:

Food

Yard Trimmings

Other Organic By-Products

Electronics:

End-of-life electronics includes computers and peripherals (CPUs, keyboards, monitors), televisions, VCRs, stereos, cell phones, etc.

Tires:

Total Tire Scrap

A glossary of definitions is included in Appendix A.

1.2.3 Economic Measures

The economic impacts upon Iowa's economy will be estimated using the following measures:

- Industrial output;
- Total income;
- Value added; and

- Number of jobs.

These outputs will be characterized as:

- Direct values (firm specific);
- Indirect values (inter-industry linkage as measured by the purchase of intermediate commodities or industrial inputs);
- Induced values (economic change stemming from personal consumption or household values); and
- Total impacts (the sum of direct, indirect, and induced).

In addition, total income and job multipliers will be generated for various recycling activities by commodity type. A multiplier is calculated by dividing the total values (impacts) by the direct values (impacts).

1.3 Key Assumptions

The following key assumptions are critical to the Study's analysis:

- The estimated current impacts are based on 2005 calendar year survey data from Iowa recycling establishments and reasonable extrapolation of the quantities by materials type.
- All incremental benefits that may accrue as a result of recycling collection activities are considered nominal, when compared to the collection activities associated with these materials if they were not diverted from disposal.
- The processor level is the point at which initial value is added to the recyclable commodities.
- The economic analysis does not account for the avoided disposal costs of the recyclable materials.
- The economic analysis for end-users measures the economic "importance" of the recycling industry to Iowa's economy, as opposed to a measure of the current economic impacts. The term “economic impact” represents production destined for export sales or for production that clearly substitutes for a commodity that must be imported. Economic importance represents overall value to the Iowa economy.
- Where net state and local fiscal impacts reflect a positive value, the impacts on population, employment, and income are likely to generate more fiscal revenues than costs.

1.3.1 Approach

The project tasks and approach are summarized below.

1.3.1.1 Task 1: Project Kick-Off

A Kick-Off Meeting was held to confirm the Scope of Work (tasks detailed below) and the schedule, and discuss IDNR staff responsibilities.

1.3.1.2 Task 2: Collect Data

The task to collect data included the following subtasks:

2A: Design Survey. R. W. Beck revised the survey used in the 2001 Study and forwarded it on to the IDNR for comments. A copy of the final survey and cover letter is attached in Appendix B.

2B: Administer Survey. R. W. Beck sent out the surveys which included a cover letter from the IDNR.

2C: Data Analysis and Fill Data Gaps. Because a certain percentage of contacted establishments declined to participate in the survey, R. W. Beck filled the data gaps in one of three ways:

1. If the establishment provided data to R. W. Beck for the 2001 Study, that data was used as a frame of reference for developing a 2005 estimate. In other instances, IDNR staff assisted the project team in gathering survey data through direct contacts with various recycling establishments.
2. R. W. Beck requested assistance from the IDNR to estimate the size of the non-responding establishments. The IDNR provided information on certain companies, such as the number of employees. R. W. Beck used that information in combination with average per-employee throughput, payroll, and receipts data from reporting establishments to estimate overall economic values.
3. R. W. Beck determined average per-establishment employment, payroll, and receipts. These statistics, along with available U.S. Census data, were used to estimate data for non-responding establishments.

1.3.1.3 Task 3: Commodity Flow Analysis

The Commodity Flow Analysis is the same procedure that R. W. Beck used in the previous two studies:

3A: Iowa Commodity Flow Analysis. Using survey data, R. W. Beck summarized estimated processed supply, imports, exports, and end-users for each commodity type.

3B: Supply/Demand Balance for Recyclable Commodities. R. W. Beck developed a “processed supply/demand matrix” to estimate the balance of recovered supply and demand.

1.3.1.4 Task 4: Economic Impact Analysis

The Economic Impact Analysis utilized the same procedure used previously by R. W. Beck and its subconsultant, David Swenson Consulting, with three minor modifications:

1. Industrial classification systems have changed since the last effort (discussed in Section 4.1 of this report);
2. The current Study included additional categories for consideration (end-of-life electronics and tire scrap), as well as an additional survey to the remanufacturing and reuse industry; and
3. The procedures for calculating economic multipliers have been modified to include elements of the economy that were excluded in earlier models.

4A: Construct I-O Model. The IMPLAN model was used to produce direct, indirect and induced economic data and multipliers for commodity categories (collection, processing, recycling equipment manufacturing, remanufacturing, etc.).

4B: Interpretation of Results. A written summary of the economic impacts of recycling was provided by R. W. Beck.

1.3.1.5 Task 5: Fiscal Impact Analysis

Because an estimate of the direct, indirect, and induced effects of recycling activities provides only a portion of the financial impacts associated with current recycling activities, an analysis was completed of the fiscal aspects of government in the context of revenues and expenditures. This task analyzed the fiscal impacts using a fiscal impact model for determining the changes in own-source revenues for state and local governments that are due to labor income changes in economic impact analyses. Own-source revenues reflect all property, income, sales, and business taxes; all charges for services; and all miscellaneous revenue sources and are the elements of state and local finance that are directly linked to area economic activity.

5A: Local Government Revenue Analysis. Fiscal impacts of recycling activities in Iowa were estimated based on locally-generated tax and non-tax revenues. In addition, the results included urban and rural summaries on a statewide basis.

5B: State Government Revenue Analysis. Own-source revenue impacts of recycling activities were estimated based on state income, sales, and use taxes.

5C: Interpretation of Results. R. W. Beck characterized the fiscal impacts of current recycling activities on Iowa local and state government.

1.3.1.6 Task 6: Comparison of 2005 Impacts to 1999 Impacts

R. W. Beck compared the 2005 data with the 1999 data and summarized the changes that have occurred, unmasked by inflationary and commodity price fluctuations.

1.3.1.7 Task 7: Greenhouse Gas Emissions Impact Analysis

R. W. Beck assessed greenhouse gas emissions reductions associated with Iowa's recycling industry using the U.S. Environmental Protection Agency's Waste Reduction Model (WARM). The aggregated recyclable materials data, by material type, were used as a basis for calculating the GHG savings using WARM. The final analysis summarized the estimated statewide greenhouse gas emissions reductions as a result of recycling activities in the state.

1.3.1.8 Task 8: Project Report

A draft project report summarized the information and included R. W. Beck's analyses. Collaboratively, R. W. Beck and the IDNR finalized the report. R. W. Beck presented the results to the IDNR and the Iowa Department of Economic Development.

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Section 2
RECYCLING DATA COLLECTION

2.1 Introduction

A comprehensive statewide survey of collectors, processors, end-users, brokers, remanufacturers, reuse establishments, and recycling equipment manufacturers was undertaken to gather recyclable materials quantity and recycling economic-related information.

2.2 Methodology

To gather the needed recycling data, the R. W. Beck Project Team worked with IDNR staff to complete the follow steps:

- Develop a comprehensive list of businesses/organizations to survey;
- Draft a written survey and accompanying cover letter to reflect various combinations of recycling activities; and
- Administer the survey to the targeted list of recycling organizations.

2.2.1 Database of Recycling Entities

The IDNR compiled a list of private businesses and public organizations to survey. This list was reviewed to identify duplications and other businesses/organizations involved in the recycling of commodities that were not on the survey list. A master list of entities to survey was developed that included collectors, processors, end-users, brokers, remanufacturers, reuse establishments, recycling equipment manufacturers, and entities involved in a combination of these activities. The database survey list was finalized to include approximately 1,365 recycling businesses and organizations.

2.2.2 Development of Surveys

Upon completing the list of those to be surveyed, the R. W. Beck Project Team, in conjunction with IDNR staff, developed a written survey to be administered to the various entities. The survey was drafted to gather the following information:

- Accurate contact information;
- Recycling activities conducted;
- Employment, payroll, and gross sales information;

- Recyclable material quantity and pricing information; and
- Perceived barriers and drivers to recycling in Iowa.

One survey was developed with six separate sections for each of the following types of recycling entities:

- Collectors;
- Processors;
- End-users;
- Brokers;
- Remanufacturers and Reuse Establishments; and
- Recycling Equipment Manufacturers.

The definitions of the six categories were outlined in the survey directions and respondents were asked to determine what sections of the survey applied to their business. All respondents were asked to complete Section 7 of the survey, titled General Opinion Questions. Cover letters were developed and sent with the survey. A copy of the survey can be found in Appendix B of this report.

2.2.3 Administering of Survey

The cover letter and survey were mailed to the private businesses and public organizations on the finalized database list.

The process used to obtain both accurate and measurable responses to the surveys involved a three contact approach. Approximately two to three weeks after forwarding the surveys, the R. W. Beck Project Team staff attempted to reach by phone the contact persons for the survey recipients flagged as “priority” by IDNR staff. This priority list was composed of over 600 businesses, organizations, and municipalities from the database of the 1,365 surveyed. If we were successful in reaching the identified contact persons, the contact information was confirmed and the recipient was encouraged to complete the survey and return it to R. W. Beck as soon as possible. A systematic protocol was used to explain objectives of the survey and obtain accurate information from the recipient. If we were unsuccessful in reaching the contact persons, we attempted to leave messages for the identified individuals.

Overall, we attempted to reach the targeted survey recipient at least three times before considering companies as non-respondents. After approximately eight weeks, the R. W. Beck Project Team reviewed the list of respondents and identified processors and end-users who had not responded. From this list, IDNR and R. W. Beck staff attempted to contact the processors and end-users handling large quantities of materials to obtain the needed data. The objective was to gather data from those entities considered to play a "significant" role in recycling in Iowa.

2.2.4 Survey Results

Of the approximately 1,365 surveys mailed, 207 were returned for a response rate of fifteen percent.

A summary of the survey results by recycling activity including employment, payroll, and material quantities is provided below.

Table 2-1
Summary of Survey Results
(2007 Study)[1]

Recycling Activity	Total Quantities (tons per year)	Total Employment (FTE)	Total Payroll ($ million)
Collection	379,876	511	14.6
Processing	1,304,620	1,004	24.6
End-Use	2,922,188	4,465	115.2
Remanufacturing/ Reuse	165,217	534	9.0

[1] All data is for calendar year 2005 and represents the documented survey information.

2.2.4.1 Recyclable Material Quantities

The individual survey responses were input into a materials flow model for collectors, processors, end-users, remanufacturers/reuse establishments, and brokers. Raw data was summarized by commodity type for each survey group. In instances where the respondent provided an aggregated total (i.e., Total Paper), this total was allocated by commodity types (i.e., ONP, OCC, High Grade, and Other Paper) in that particular category based upon the average distribution for the other respondents involved in this activity (i.e., processors of paper).

For the collectors, an additional level of distribution was necessary to calculate the residential-commercial mix for collectors identifying materials collected in commingled form. This calculated residential-commercial split is based on the percentage split among respondents providing detailed residential-commercial recycling quantity information. This calculation for the collectors was completed prior to segregating the material types (i.e., Total Paper) by commodity type (i.e., ONP, OCC, High Grade, and Other Paper).

2.2.4.2 Recyclable Material Pricing

The per-ton prices for each of the recyclable commodities were calculated using two approaches. First, the average price per ton was calculated based upon the average prices per ton by commodity type reported by the survey respondents. Because of the limited pricing information provided by respondents, a second approach was undertaken to supplement the survey respondent pricing information. The monthly commodity prices in 2005 as reported in industry sources including "Waste News" and

"Official Board Markets" were reviewed for the Central Region of the United States. An average annual price per ton was calculated for each of the recyclable material commodities. Providing survey-specific average per ton pricing information, as well as an annual average per ton price from a reputable source within the industry, was designed to provide a comprehensive baseline in which to calculate the gross sales. The gross sales were calculated using the material quantity and pricing information to develop gross sales input information.

Section 3
COMMODITY FLOW ANALYSIS

3.1 Overview

The objective of this task is to utilize the data gathered through the Study's survey efforts to identify potential opportunities for enhancing recycling market development. To identify these commodity opportunities, the Project Team considered the following criteria:

- Reliability and completeness of the survey data;
- Quantities of recyclable materials imported into Iowa for processing and end-use; and
- Overall documented commodity supply as compared to documented demand.

Company specific information from the survey results is not detailed because the Study methodology specified confidentiality for all respondents as related to company specific information.

3.2 Recyclable Materials Flow

To initiate the analysis, the quantitative survey data for the recyclable materials was aggregated by commodity type. Total 2005 tons collected, processed and consumed by Iowa entities was estimated based on the survey responses. Then, the quantities of recyclable materials imported by processors and end-users were calculated. The quantity of in-state commodity purchases were subtracted from the overall total quantities purchased for each individual respondent to calculate the quantity of imports. The imports for individual respondents were summed by commodity type to identify the total imports for each commodity. The commodity imports identified in the recyclable materials flow may represent a supply/demand imbalance because the import of materials may be due to lack of supply in Iowa. The exports for collectors also were calculated but the focus of the review is at the processor and end-user level. The 2005 Iowa Recyclable Materials Flow is provided below.

Table 3-1
Iowa Recyclable Materials Flow
2005 Tons[1]

COMMODITY	COLLECTORS		PROCESSORS		END-USERS	
Material Types	Total Collected[2]	Exported	Total Processed[2]	Imported (Calc)[3]	Total Consumed[2]	Imported (Calc)[3]
PAPER	91,543	6,582	338,252	20,959	1,167,178	902,088
Newspaper	40,603	4,301	61,350	10,335	14,406	5,533
Old Corrugated Containers	24,794	1,494	193,969	8,982	983,509	834,813
High Grade	341	71	9,852	181	-	-
Other Paper	25,805	716	73,082	1,461	169,263	61,742
PLASTICS	7,288	1,946	25,788	7,700	10,214	1,742
PET	2,334	476	4,715	52	-	-
HDPE	1,069	389	8,765	6,096	7,000	-
PVC	-	-	101	-	-	-
LDPE	123	93	1,837	-	930	30
PP	126	126	156	-	124	124
PS	1	-	134	-	-	-
Mixed Plastics	3,636	862	10,080	1,552	2,160	1,588
GLASS	22,974	13,097	37,260	42	-	-
Clear (Flint)	4,521	3,962	5,704	-	-	-
Brown (Amber)	6,441	6,161	21,688	-	-	-
Green/Blue	3,026	2,921	3,139	-	-	-
Mixed Glass	8,987	53	6,729	42	-	-
METALS	34,954	2,175	172,976	20,862	1,607,620	917,418
Steel Cans	1,972	298	2,580	140	-	-
Aluminum Cans	4,704	1,281	8,926	13	-	-
Ferrous Scrap	18,205	-	147,456	19,786	1,605,450	915,248
Non-ferrous Scrap	10,073	596	14,014	924	2,170	2,170
WOOD SCRAP	30,110	4,000	179,496	23,710	44,000	27,500
SUB-TOTALS	186,869	27,799	753,772	73,273	2,829,012	1,848,748

Table 3-1
Iowa Recyclable Materials Flow
2005 Tons[1]

COMMODITY	COLLECTORS		PROCESSORS		END-USERS	
Material Types	Total Collected[2]	Exported	Total Processed[2]	Imported (Calc)[3]	Total Consumed[2]	Imported (Calc)[3]
CONSTRUCTION & DEMOLITION	20,969	24	207,236	118	1,000	-
Asphalt	4,979	-	57,112	-	1,000	-
Concrete	5,382	-	146,411	-	-	-
Drywall	5,781	-	-	-	-	-
Carpet	36	-	118	118	-	-
Carpet Pad	539	24	-	-	-	-
Asphalt Shingles	2,742	-	3,595	-	-	-
Other Mixed C&D	1,510	-	-	-	-	-
ORGANICS	80,454	-	291,837	5	91,000	19,000
Food	500	-	11,071	-	-	-
Yard Trimmings	67,273	-	107,799	5	-	-
Other Organic By-Products	12,681	-	172,967 -	-	91,000	19,000
ELECTRONICS	634	34	522	107	-	-
TIRES	90,950	28,891	51,253	11,747	1,176	876
TOTALS	379,876	56,747	1,304,620	85,250	2,922,188	1,868,624

[1] Represents only the quantities documented based upon the survey conducted by R. W. Beck as related to the Economic Impacts of Recycling study. It does not represent 100% of the materials collected, processed, or used in Iowa.
[2] Totals may not sum due to rounding.
[3] These estimates are calculated by aggregating the data received from the individual respondents concerning overall commodity purchases as compared to in-state commodity purchases.

3.3 Data Limitations

The data characterized above have limitations as related to measuring Iowa's overall recyclable materials supply and demand. Some survey respondents failed to differentiate between the quantities of materials originating from Iowa suppliers and the quantities originating from out-of-state suppliers. In these instances, it was assumed these quantities were generated by Iowa suppliers.

Survey responses were not obtained from all Iowa recycling firms and community programs. As a result, the documented quantities per the survey do not represent 100% of the recyclable materials collected, processed, and end-used within Iowa. Yet, the Project Team worked collaboratively with IDNR staff to identify major recycling industry organizations and attempted to gather information from those key organizations. Information was received from the major processors and end-users based on quantities managed.

3.4 Materials Supply and Demand

The Project Team reviewed the recyclable materials flow to assess the supply and demand for the various commodities. The processor information is compared to the end-user information to undertake the supply/demand analysis. A brief analysis is provided below by commodity type. All tonnages are for the calendar year 2005.

3.4.1 Paper

3.4.1.1 Old Newspaper

The supply of ONP appears to be substantially greater than the demand for ONP. Approximately 61,350 tons of ONP were processed but only 14,400 tons were consumed in Iowa. Thus, additional ONP consumption represents a recycling market development opportunity in the State. However, the overall differential is not large enough to offer an opportunity for an ONP recycling mill, but for smaller more decentralized end uses, such as cellulose insulation or egg carton manufacturing.

3.4.1.2 Old Corrugated Containers

Nearly 194,000 tons of OCC was processed in Iowa in 2005. Approximately 983,500 tons were consumed. Out of the total tons consumed, only 149,000 represents the portion of materials estimated as generated in Iowa. This results in almost 835,000 tons of OCC being imported to Iowa for consumption. Based upon the documented survey information, it appears that the demand for OCC substantially exceeds the quantity of OCC collected and processed in Iowa. It should be noted that long-term contractual relationships between processors and end-users may influence the quantity of materials imported. Yet the large quantity of OCC materials imported certainly represents, at some level, a recycling market development opportunity for processors of OCC.

3.4.1.3 High Grade Paper (Office Paper)

The quantity of high grade paper processed in 2005 was 9,900 tons yet none of the end-user survey respondents reported any tons consumed in the state of Iowa. These results suggest none (or perhaps a very small portion) of the high grade paper processed in the state is being consumed in Iowa, so the total supply exceeds the demand for this material. These results represent an imbalance in the supply and demand. However, some survey respondents may have included office paper quantities with “other” or mixed grades of paper. This issue should be further researched before determining if a market development opportunity exists.

3.4.1.4 Other Paper (Other Grades & Mixed Paper)

Approximately 73,000 tons of mixed paper was processed in Iowa in 2005 while 169,000 tons were consumed. Out of the documented tons consumed, 61,700 tons were imported. Based on this data, it appears that demand exceeds the quantity of mixed paper processed in Iowa. It should be noted that the definition of "other" or mixed paper is relatively fluid and may have impacted the survey responses. Moreover, long-term contractual relationships between processors and end-users may influence the quantity of materials imported. Again, specifications of the consumed fiber should be researched prior to finalizing conclusions as to a recycling market development opportunity.

3.4.2 Plastics

3.4.2.1 PET

The amount of PET plastic processed in Iowa in 2005 was 4,700 tons, while no tons were documented as consumed by Iowa end-users. This may offer an opportunity for a PET end-user, but the amount processed seems to underestimate the quantity of PET collected, considering Iowa’s Beverage Containers Control Law or “Bottle Bill”.

3.4.2.2 HDPE

Almost 8,800 tons of HDPE were processed in 2005, and 7,000 tons were consumed. It should be noted that none of the tons consumed were imported for end use. Supply appears to be only slightly greater than demand. More research is recommended concerning the extent of the HDPE processors and end-users.

3.4.2.3 LDPE

The quantity of LDPE processed in Iowa in 2005 was 1,800 tons, while 930 tons were consumed. Of the amount consumed, only 30 tons were reported to be imported. The supply appears to be greater than demand. More research is recommended concerning the extent of the LDPE processors and end-users.

3.4.2.4 Mixed Plastics

Approximately 10,000 tons of mixed plastics were processed in Iowa in 2005, but only 2,000 tons were consumed. The supply of mixed plastics appears to exceed the demand and may offer an opportunity for an end-user of mixed plastics.

3.4.2.5 PVC, PP & PS

The amounts reported of other types of plastics processed and consumed were negligible.

3.4.3 Glass

The amount of glass processed in Iowa in 2005 was over 37,000 tons. It is believed that the majority of this glass is container glass via the Iowa "Bottle Bill". Because there were no survey responses from end-users of glass in the state, the supply of glass is believed to be shipped out of state for glass-to-glass recycling. Some glass may be crushed and used for sandblasting, road bed construction, drainage filter media, landfill cover, and other alternative uses. While there appears to be a greater supply of glass than there is demand, more research on the extent of alternative uses should be undertaken to determine local end-markets.

3.4.4 Metals

3.4.4.1 Steel Cans

Approximately 2,600 tons of steel cans were processed in Iowa in 2005. No tons were reported consumed, indicating supply exceeds demand.

3.4.4.2 Aluminum Cans

Almost 9,000 tons of aluminum cans were processed in Iowa in 2005. Because no end-users of aluminum can scrap were identified, it appears that supply exceeds demand.

3.4.4.3 Ferrous Non-Container Scrap

The amount of ferrous scrap reported as processed in Iowa was nearly 147,500 tons. Because 1.6 million tons were consumed (includes auto bodies per survey responses), and over 900,000 tons were imported for consumption, it is estimated that approximately 690,000 tons of Iowa-generated ferrous was consumed. Thus, it appears that the total amount of ferrous processed in Iowa is under-represented, based on end-user survey responses. More data on processors of ferrous scrap should be gathered regarding this commodity to assess the supply and demand.

3.4.4.4 Non-Ferrous Non-Container Scrap

Survey results indicate that approximately 14,000 tons of non-ferrous scrap was processed in Iowa in 2005, while only 2,000 tons were consumed. Of the amount consumed, 100% was imported. Supply appears to exceed demand, however only imported tons were reported by end-users. More research on end-use is needed.

3.4.5 Wood

Nearly 180,000 tons of wood scrap were processed in Iowa in 2005. Because approximately 44,000 tons were consumed, and 27,500 tons were imported for consumption, approximately 16,500 tons of Iowa wood scrap was consumed. This indicates that supply exceeds the demand for this material. Based on our knowledge of the wood scrap industry, the supply typically exceeds the demand for this commodity type.

3.4.6 Construction & Demolition

3.4.6.1 Asphalt

Over 57,000 tons of asphalt were reported processed in 2005, while only 1,000 tons were consumed. Likely end-users of asphalt may not have been surveyed. It is common for asphalt to be removed, crushed, and then reapplied during the construction of a new roadway. Typical road construction companies were not included in the recycling survey. More research on end-use is recommended before drawing specific conclusions.

3.4.6.2 Concrete

Over 146,000 tons of concrete were reported processed in 2005, while no end-users reported consuming concrete. Likely end-users of concrete may not have been surveyed. Similar to asphalt, recovered concrete often becomes aggregate for road base during the construction of a new roadway. However, most concrete is removed from the construction site to be crushed because the rebar must be removed as well. Typical road construction companies were not included in the recycling survey. More research on end-use is recommended before drawing specific conclusions.

3.4.6.3 Drywall

No drywall was reported by survey respondents as having been processed or consumed in 2005.

3.4.6.4 Asphalt Shingles

Survey results indicate 3,600 tons of asphalt shingles were processed in 2005. No end-users for this material were documented, but it is likely that end-users of this material are active in Iowa. More research on end-use is needed.

3.4.6.5 Carpet and Carpet Padding

Carpet tonnages processed were negligible at 118 tons, and no consumption was reported. No carpet padding tonnages were reported.

3.4.7 Organics

3.4.7.1 Food Residuals

Approximately 11,000 tons of food residuals were processed in Iowa in 2005 based on survey results. Most likely the food residuals are composted with yard trimmings. No end-users for this material responded to the survey. More research on end-use is recommended before drawing specific conclusions.

3.4.7.2 Yard Trimmings

The amount of yard trimmings processed was 108,000 tons in 2005. No end-users were documented, resulting in excess supply. Given the varied types of potential end-users, it would be difficult to effectively survey all yard trimmings end-users. It should be noted that there is a significant reduction in the volume of yard trimmings after it is processed/composted, thus for every ton of yard trimmings composted there is not one ton of compost produced. Moreover, based on our knowledge of yard trimmings operations, the supply typically exceeds the demand for this commodity type and many municipalities provide the finished compost to residents at no charge. Iowa has also experienced tremendous growth in the use of compost in nursery, sports turf, and erosion control activities in the last three to five years.

3.4.7.3 Other Organic By-Products

Approximately 173,000 tons of other organic by-products (manures, biosolids, industrial by-products, etc.) were reported processed in 2005. The reported tons consumed was 91,000 tons. However, it is not evident from the survey respondents that the material processed was the same type of material consumed. It is likely these materials were used as inputs to composting operations.

3.4.8 End-of-Life Electronics

Approximately 500 tons of electronics (including computers, keyboards, monitors, televisions, VCRs, stereos, cell phones, etc.) were reported as processed in 2005, while no end-users reported consuming electronics. The supply of used electronics parts are likely to have been shipped out of state.

3.4.9 Tires

Over 51,000 tons of tires were processed as tire scrap in 2005, while less than 1,200 tons were reported as consumed in Iowa. Most likely the tire scrap is transported out of state to be used as an alternative fuel or made into crumb rubber for various civil engineering applications.

The table below summarizes the supply/demand assessment.

Table 3-2
Materials Flow Commodity Analysis

Material	Supply/Demand Status
ONP	Excess supply
OCC	Excess demand
High Grade (Office)	More research needed
Other Paper (Mixed)	More research needed
PET Plastics	Excess supply
HDPE Plastics	Supply slightly greater than demand
LDPE Plastics	Excess supply
Mixed Plastics	Excess supply
Container Glass	Excess supply
Steel Cans	Excess supply
Aluminum Cans	Excess supply
Ferrous	More research needed
Non-Ferrous	Excess supply
Wood	Excess supply
Asphalt	More research needed
Concrete	More research needed
Drywall	No data reported
Asphalt Shingles	More research needed
Food Residuals	More research needed
Yard Trimmings	Excess supply
Other Organic By-Products	More research needed
End-of-Life Electronics	Excess supply
Tires	Excess supply

3.5 Summary

With the exception of OCC and those commodities requiring more research, it appears that there is excess supply to meet the present demand for most recycled material commodities in Iowa. Based solely on the data gathered above and our knowledge of the industry, we recommend consideration of the following preliminary recycling market development opportunities:

- Facilitate additional development of the Iowa processing infrastructure for OCC to meet documented in-state demand;
- Promote new end-users of ONP by focusing on quality and quantity of fiber available;

- Promote new end-users of various recycled plastics, with emphasis on PET because of the quantity of the available supply of this recycled material;
- Promote the research and development of alternative end-uses for container glass;
- Further document the processing of ferrous metals to compare the supply to the present demand for these materials;
- Gather more data and promote development of end-users of organics and construction and demolition materials;
- Facilitate additional development of the Iowa end-use infrastructure for end-of-life electronics; and
- Promote the research and development of alternative end-uses for tires.

The above preliminary recommendations should be considered in the context of the economic impacts analysis and its results to prioritize the opportunities.

Section 4
RECYCLING INDUSTRY ECONOMIC VALUES IN IOWA

4.1 Introduction

In 1996 a framework for estimating the statewide economic impacts or values from recycling activities in Iowa was developed. That framework was repeated and refined in 2001, and again applied in this Study. There are three elements necessary for assessing recycling industry economic values: (1) reliable survey information of specific industries; (2) reliable recycling industry expertise; and (3) a set of protocols for translating recycling industry information into standard industrial measures of economic activity. This section focuses on applying the last element.

Measures of regional economic values may be estimated with the use of input-output (I-O) models of the area of study. I-O models are highly detailed accountings of the flow of commodities and finished goods among industries and ultimately, to final consumers. The model that we use in our assessment is called Implan Pro™. It contains detailed information on up to 509 commodity production sectors as well as consuming institutions and households[1]. The foundation data that are used in this model are updated annually, so the modeling structure is highly reflective of the existing economy in the area that is being studied.

At the heart of the I-O model are measures of which industries *use* specific commodities and which industries *make* those commodities, along with an accounting of their presence in an area of study. With the industrial composition of a region known and documented, successive rounds of transactions stemming from an initial purchase or the sale of a commodity or some other economic event can be summed to provide an estimate of:

1. **Direct values** (usually firm or activity specific);
2. **Indirect values** (inter-industry linkages as measured by purchases of intermediate commodities – these purchases are also call industrial inputs);
3. **Induced values** (economic change driven by personal consumption – these values are also called household values); and

[1] The modeling system and data that were used for previous studies were manufactured and distributed by the IMPLAN company, but were configured under the U.S. Standard Industrial Classification (SIC) System. Beginning in 2004, IMPLAN systems converted to the new North American Industrial Classification System (NAICS).

4. **Total values** (the sum of 1 through 3) for all industries "impacted" by the economic event in the region under study.

Four standard economic values are estimated for the following:

- **Total industrial output** as a measure of gross sales.
- **Value added** is comprised of all income from employee compensation, payments to sole proprietors, income from investments, and indirect tax payments to governments (sales, excise, and use taxes) that are part of the production process.
- **Labor income** represents the value of all wages, salaries and salary-like benefits paid to workers. It also includes the normal payments to ownership and management that are made to sole proprietors. Labor income is a subset of value added.
- **Jobs in the region** are defined as the number of positions that exist in an industry, not the number of working persons. Because many people hold more than one job, there are more jobs in an economy than there are employed persons.

4.2 Methodology

For purposes of this Study, "economic impact" is where a discernible and measurable change in economic activity in a region is occurring. These changes come about, primarily, from three types of occurrences:

1. Commodity production intended primarily for export either starts-up or closes-down. This includes traditional industrial sales along with tourism and recreation activities that depend on spending from visitors. This can also include higher level service provision, such as regional or national medical centers, where a large fraction of services that are delivered accrue to persons living outside of the local trade area.
2. The development of industries locally that are substituted for historical imports, or "import substitution". Much of recycling can often take the form of import substitution.
3. Focused and significant government institutional spending. Examples include state or federal hospitals and specialty schools, higher-education facilities, military bases, and prisons. Each of these represent a consolidation of public spending in a small area that provides public goods that are significantly in excess of local needs.

When the industrial activity that we are measuring clearly fits into one of these three categories, for the purposes of this Study, we characterize this activity as "economic impact". If the activity does not fit into one of these three groupings for purposes of this Study, we characterize this activity as an "economic value".

The processing of recycled commodities, either as producer inputs or as final goods, generally does not "fit" standard industrial groups. A few instances, such as paperboard, metals, and aluminum manufacturing have historically strong inter-industrial linkages with the byproducts or the waste streams of other industries. Other commodities such as glass, plastics, construction and demolition materials, and organics processing are not well-represented in standard industrial groupings or are lost or subsumed with much larger sectors that are dominated by industries that do not use recycled feedstocks.

The flow of industrial activity in recycling industrial analysis begins with collecting recyclable materials, processing them into industrial inputs or intermediate raw materials, and the end-use of processed recycled commodities in the production of final goods intended for household or institutional consumption. Information from a survey of collectors, commodity processors, and end-users was collected in late 2006 and early 2007. These data were used to manually change our I-O model to identify the industrial values of recycling in Iowa and their implicit relationships. In effect, we introduced these industries into our model and manipulated the other industries and institutions represented to mathematically acknowledge them. We also linked these industrial activities together. Collection is an industrial input for recycling commodity processing. Recycled commodity processing, by particular commodity type, is an input to specific end-use manufacturing.

Data for this Study were collected for collection, processing, and end-use manufacturing for the following commodities:

- All Paper
  - All other paper
  - OCC
- Plastics
- Glass
- Metals
  - All other metals
  - Aluminum
- Wood Scrap
- Organic Matter
- C&D Materials
- Used Tires
- End-of-Life Electronics

The survey data of estimated tonnage collected, processed, or consumed, along with sales, employees, and employee compensation were compiled and introduced into our modeling system to assess both the economic impacts of commodity production and the estimated economic value to the state of Iowa of end-use manufacturing activities.

4.3 Study Assumptions

As in the previous studies, there are several assumptions that are implicit in the economic modeling:

- The types of materials that are collected by kind and by source (residential and commercial) documented in the survey are indicative of the overall statewide distribution of recyclable materials that are collected.
- All recycled commodities that are collected and sold within the state are processed by in-state industries.
- All brokering activities along any continuum of recycling industry activity are subsumed within the purchase prices paid for the recycled commodity either by the processor or by the end-user.
- The prices received per commodity by collectors and by processors are based on reported regional market averages.
- The appropriate point for economic impact analysis for recycling is at the processor level because that is the point at which initial value is added to the recycled commodity, although the overall economic values of end-use industrial activity and of recycling equipment manufacture are documented and reported. Exported sales of collected recyclable material are also considered economic impacts in that they represent sales in excess of statewide industrial demand.
- All incremental benefits that may accrue as a result of recycling collection activities are considered nominal when compared to the collection activities associated with these materials if they were not diverted from disposal.

4.4 Establishing a Baseline

4.4.1 Paper, Plastics, Glass, Metals, and Wood

Table 4-1 itemizes the base values that were used to modify and compile the I-O model for Iowa and its recycling-related industries. These summaries align with previous studies and do not include organics, C&D debris, used tires, and end-of-life electronics (electronics). The allocations of the collected commodities were derived from the survey information and by follow-up phone-calls with key industrial groups.

By our estimate, it was determined that 1.2 million tons of recyclable commodities were collected in Iowa in 2005. Residential collections accounted for approximately 300,000 tons, and commercial collections accounted for approximately 900,000 tons. The majority of collected material, by weight, was paper. In 2005, paper accounted for approximately 49 percent of all commodities collected. Of the total tons collected, 178,514 tons were exported, leaving 1,021,486 tons (85 percent) available to in-state processors, as shown in Table 4-1.

Table 4-1
Estimated Recycled Commodities Collected by Type and Source
(2007 Study)[1,2]

Material Types	Total Tons Collected[3]	Residential Tons Collected	Commercial Tons Collected	Total Tons Exported	Net Iowa	Expected 2005 Gross Receipts
All Paper	587,853	146,963	440,890	42,264	545,589	$25,569,005
OCC	159,218	39,804	119,413	9,592	149,625	6,079,214
All Other Paper	428,636	107,159	321,477	32,672	395,964	19,489,790
Plastics	46,804	11,701	35,103	12,495	34,309	12,754,101
Glass	147,532	36,883	110,649	84,104	63,428	3,085,338
Metals	224,460	56,115	168,345	13,965	210,495	111,659,888
Aluminum Cans	30,205	7,551	22,654	8,226	21,979	33,788,015
All Other Metal	194,255	48,564	145,691	5,739	188,516	77,871,873
Wood Scrap	193,352	48,338	145,014	25,686	167,665	6,187,259
Total	1,200,000	300,000	900,000	178,514	1,021,486	$159,255,591

[1] All data is for calendar year 2005.
[2] Totals may not sum due to rounding.
[3] Estimated from extrapolating 2005 survey results.

Assuming that all of the collected tonnage was sold at reported regional prices (i.e., commodity indices), the expected receipts for these recyclable materials are $159.3 million. A large fraction of that total, 70 percent, is in the metals sector. All collected paper was expected to generate $25.6 million in receipts, plastics another $12.8 million, wood scrap $6.2 million, and glass $3.1 million.

As a refinement to previous studies in Iowa, we have determined that the value of recycled commodities that are collected in Iowa and exported outside of the state represents receipts that otherwise would not have been received but-for the recycling activity in Iowa. Hence, the value of the exports is considered an economic impact and a summary of those values will be presented later in this section.

Table 4-2 displays the estimate of the total amount of recyclable commodities that are actually processed in Iowa. These distributions were derived from the survey of processors and end-users in Iowa. The totals are assumed to be, by commodity, representative of the distribution of processors activities in Iowa. Characteristics of C&D debris, organics, used tires, and electronics processing are discussed later in this section.

Table 4-2
Estimated Recycled Commodities Processed by Type and Source
(2007 Study)[1,2]

Material Types	Iowa Suppliers[3] Tons	Imported Tons	All Suppliers Tons	Expected 2005 Gross Receipts
All Paper	545,589	36,039	581,628	$36,987,435
OCC	149,625	7,265	156,891	11,296,117
All Other Paper	395,964	28,774	424,737	25,691,318
Plastics	34,309	14,607	48,916	17,928,088
Glass	63,428	72	63,499	1,125,407
Metals	210,495	28,858	239,353	119,531,111
Aluminum Cans	21,979	31	22,010	25,531,670
All Other Metal	188,516	28,827	217,343	93,999,441
Wood Scrap	167,665	25,518	193,183	5,022,769
Total	1,021,486	105,093	1,126,579	$180,594,810

[1] All data is for calendar year 2005.
[2] Totals may not sum due to rounding.
[3] Data is derived from Table 4-1 and is extrapolated from 2005 survey results.

We estimate that the total amount of processed recycled commodities in Iowa in 2005 was 1,126,579 tons. As with collections, paper processing amounted to the preponderance of the tonnage at 53 percent. All metals accounted for 21 percent, and wood scrap accounted for 16 percent. Total expected receipts for these processed goods were quite large, given average per ton prices in effect at the time. In 2005, these processed commodities, if sold at regional average prices, would have amounted to nearly $181 million. Metals accounted for nearly $120 million of the total (66 percent), followed by paper at $37 million, plastics at nearly $18 million, wood scrap at $5 million, and glass at $1 million.

We have allocated the total amount of collections that are sold in-state to Iowa processors as 1,021,486 tons, compared with an estimated 105,093 tons that were purchased from out-of-state suppliers. We estimate in Table 4-2 that 90.7 percent of the commodities that are processed in these industries come from in-state resources.

Table 4-2 is very important to the subsequent modeling activities. The gross sales by major commodity become the industrial output that is entered into the I-O model. In short, the expected sales accounted for in Table 4-2 are the same amounts that the economic impact assessment will report when summed. The models were also created so that there is industrial-level sensitivity to both the amounts and costs of labor, as indicated in the survey.

4.4.2 C&D Debris, Organics, Used Tires, and Electronics Processing

There were several other categories of recycled commodity processing that were measured in the survey. The processing of C&D debris, the processing of organic matter into compost or other uses, electronic equipment de-manufacturing, and used tire processing represent important, but not as well documented, dimensions of recycling in Iowa.

C&D wastes are not well documented in terms of their collection, processing, and end-use. For example, most asphalt is simply collected, crushed, and quickly reapplied during the construction of a new roadway. Recovered concrete often becomes clean fill or is used for erosion control. Efforts have been made to re-process wood, drywall, sheet rock, and asphalt shingles, though instances of usage do not appear well documented in the state.

Of the nearly 21,000 tons of C&D material reported collected, roughly 75% was asphalt, concrete, and drywall. Of the 207,236 tons of C&D reported as processed, 71 percent was concrete, almost 28 percent was asphalt, and less than 2 percent was asphalt shingles.

With regard to organic waste, nearly all of the landfills in Iowa actively divert yard trimmings and other organic matter into public or private composting operations. The finished material is often simply given to the public for residential benefit, used for erosion control, or applied as a soil amendment on public land. Thus, much of the collection, diversion, processing, and distribution of this material falls outside traditional economic industrial activities.

From the survey data, of the 80,454 tons of collected organic wastes, nearly 84 percent were yard trimmings, 16 percent were other organic by-products, and food residuals made up less than one percent. Of the 291,837 tons reported as processed, 59 percent were classified as other organic by-products, 37 percent yard trimmings, and 4 percent food residuals.

End-of-life electronics are disassembled into their useful and recoverable components in which motors, compressors, scrap plastic and metals, and circuit boards are separated and re-used or re-manufactured. The survey results indicated 634 tons of end-of-life electronics were collected and 522 tons were processed.

Processors of used tires remove the bead steel and shred the tires into varying sizes for a multitude of uses. Some of the tire products are used as tire-derived aggregate for engineering applications, playground fill, or athletic and walkway surfaces, and a large fraction is used as fuel. In 2005, approximately 56,965 tons of tires were collected from within Iowa and 29,994 tons of Iowa tires were processed. This equates to nearly 5.7 million tires collected and 3.0 million tires processed.[2] The total quantities of tires collected and processed (tons from Iowa plus tons from outside Iowa) were even higher, as shown below in Table 4-3.

Table 4-3 shows the survey results for C&D debris, organics, and electronics collection and processing, plus state tire collection and processing data. All quantities include both tons from Iowa and outside of Iowa, collected and processed.

Table 4-3
Survey Results for C&D, Organics, and Electronics Collection and Processing
Plus State Tire Data
(2007 Study)[1,2]

	Collection		Processing	
	Tons	Percent of Category	Tons	Percent of Category
CONSTRUCTION & DEMOLITION	20,969	100.0%	207,236	100.0%
Asphalt	4,979	23.7%	57,112	27.6%
Concrete	5,382	25.7%	146,411	70.6%
Drywall	5,781	27.6%	-	-
Carpet	36	0.2%	118	0.1%
Carpet Pad	539	2.6%	-	-
Asphalt Shingles	2,742	13.1%	3,595	1.7%
Other Mixed C&D	1,510	7.2%	-	-
ORGANICS	80,454	100.0%	291,837	100.0%
Food	500	0.6%	11,071	3.8%
Yard Trimmings	67,273	83.6%	107,799	36.9%
Other Organic	-	0.0%	172,967	59.3%
Other Organic By-products	12,681	15.8%	-	-
ELECTRONICS	634	100.0%	522	100.0%
TIRES[3]	87,685	100.0%	39,970	100.0%

[1] All data is for calendar year 2005.
[2] Totals may not sum due to rounding.
[3] Source of tire data: IDNR. Survey data from this Study was not used to determine quantities of tires collected and processed, because not all collectors and processors responded to the survey. Rather, State data was used, because the State has more accurate figures due to the regulated reporting requirements for tires.

[2] Source: IDNR. Survey data from this Study was not used to determine quantities of tires collected and processed, because not all collectors and processors responded to the survey. Rather, State data was used, because the State has more accurate figures due to the regulated reporting requirements for tires. It should also be noted that in 2005, the collection numbers were unusually large because approximately one million tires were abated from a tire pile and the numbers were counted as 2005 numbers.

The size of these industries in Iowa is difficult to determine from the survey data alone. As such, we will infer the size of these specific industry processors as functions of national statistics. The procedures for those allocations are discussed in Section 4.6.2, the economic impacts of processing recyclable commodities summary.

4.5 Recycled Commodity Processing and Linkages

For purposes of this Study, the economic value of a commodity is determined when the commodity is transformed into an intermediate good. Recyclable commodities are transformed into an input for further production at the processing stage. This is where the commodities receive their first significant added value and the processed commodities are then used in the production of a final good.

There are several advantages for using the processing stage to assign the initial highest value of the recycled commodities as opposed to tracking the commodity flow from household or business to collector and on to the processors. First, the value of the commodity at the collection level, in some instances, may be misleading because of the subsidies provided for recyclable materials collection. In short, the values received by consumers or businesses as measured by direct economic welfare gains are unknown. A financial or market value of recycling is not determined until the commodity is sold.[3] Even though we may know the price of commodities sold, we may not know the full amount of public sector investment as compared to the public's overall investment in solid waste disposal. Second, at the collection level, the amount of labor and capital involved with recycling may be overestimated. In general, the labor and capital needs or shifts in capital are still very similar to those needed to process solid waste in landfills. For these reasons, we have characterized collection as a margined economic benefit: this means that for *x* amount of processing sales, only a small increase in specialized labor and capital is needed to ready the commodity supply for distribution to the processors.

For the analysis of Iowa's recycled commodities processing industries, we modified industrial production factors to represent the capital, labor, and value of product sold by each commodity. In short, even though many commodity types may be processed by individual processors, we have created production functions that are sensitive to the characteristics of each commodity. These simulated commodity-processing industries, one for each specified commodity studied, are linked to the collectors (public and private recyclable materials collection), along with the traditional industrial linkages that are necessary for the production of goods (industrial equipment, finance, utilities, transportation, specialized business services, etc.). The value of these linkages was determined by adapting the characteristics of closely-related processing sectors in the original model and by shifting their demand for commodity inputs to the recycled

[3] It is not possible to calculate the economic impacts of the payments communities receive from processors for their recyclable commodities without doing a full cost accounting analysis to calculate the extent to which those payments offset "normal" costs of solid waste collection and disposal. That is why the "value added" activities of the processor become the point where economic impacts begin. However, in the aggregate, we can calculate some recycling collection economic impacts for Iowa in instances where the recycled commodities were exported to an out of state processor.

commodity collectors. Specifically, returns to capital, employee compensation, employment, and industrial output were adjusted relative to the overall value of the commodity sold per ton and the estimated labor needs to produce the product. When the model was re-compiled with these new values, all other industries in Iowa mathematically recognized the existence of the simulated recycling commodity processors.

4.6 The Economic Impacts of Recycling Commodity Processing in Iowa

4.6.1 Paper, Plastics, Glass, Metals, and Wood Processing

Table 4-4 displays the economic impacts of recycling commodity processors in Iowa. This table displays several dimensions of information about Iowa's recycled commodity processing industries including the following:

- Industrial output;
- Value added;
- Labor income; and
- Jobs.

The direct values represent the amounts for the particular industry that we are studying. The direct industrial output for all other paper, for example, is $25.7 million. That number corresponds with the expected receipts for that industry that were displayed in Table 4-2. The indirect values represent industrial inputs into production to produce the direct commodity that we are measuring. Induced activity comes about as a result of workers receiving salaries and wages and converting them into household spending. The sum of all direct, indirect, and induced values in a category yields the total economic value.

The last column is the economic multiplier. The multiplier is simply a ratio of the total economic value in a category to the direct value. It tells us the expected change in the total economy per unit change in the direct value. The jobs multiplier for all other paper is 1.64. It is derived by dividing the total jobs by the direct jobs, or *784 ÷ 478 = 1.64.* This means that for every 100 jobs in the direct industry ("All Other Paper"), 64 additional jobs are expected to be sustained in the regional economy. The labor income multiplier of 1.65, *$17,629,670 ÷ $10,672,397 = 1.65*, means that for every dollar in labor income in the direct sector, $0.65 in additional income is sustained in the rest of the economy. Multipliers explain the current relationship of the regional economy to the industry that we are measuring. Multipliers vary across commodities for the following reasons:

- Industries with very strong linkages to existing firms will generate higher multipliers, whereas firms with low regional linkages will generate lower multipliers;

- Firms that produce a high-value commodity, all other things being equal, will have higher multipliers than others; and
- Firms that provide relatively high compensation will generate high jobs multipliers as their household spending will drive more retail and service consumption in an area.

Table 4-4 shows the unique I-O results for paper, plastics, glass, metals, and wood commodity processors. The "All Other Metals" values accounted for the preponderance of output and jobs. Excepting them, the highest category for industrial output was aluminum at $36.8 million, followed by all other paper at $30.9 million and all plastics at $26.5 million. The economic multipliers are also listed. Overall, the highest average multipliers are found in the aluminum, plastics, and all other metals processing sectors[4]. This is reflective of the comparatively high value of the product produced during the measurement period and the fact that there are strong linkages from collection, to processing, to end-use in the state.

Table 4-4
Estimated Economic Impacts of Iowa's Recycled Commodity Processing Industries (2007 Study)[1]

Old Corrugated Containers	Direct	Indirect	Induced	Total[2]	Multiplier
Industrial Output($)	11,296,117	1,630,255	1,030,026	13,956,398	1.24
Value Added($)	7,746,271	2,124,261	1,619,478	11,490,011	1.48
Labor Income($)	4,245,103	1,823,142	1,371,741	7,439,986	1.75
Jobs	181	79	55	315	1.74
All Other Paper	**Direct**	**Indirect**	**Induced**	**Total[2]**	**Multiplier**
Industrial Output($)	25,691,318	3,089,808	2,131,441	30,912,567	1.20
Value Added($)	18,651,373	4,390,265	3,650,361	26,691,999	1.43
Labor Income($)	10,672,397	3,819,556	3,137,718	17,629,670	1.65
Jobs	478	174	133	784	1.64
Plastics	**Direct**	**Indirect**	**Induced**	**Total[2]**	**Multiplier**
Industrial Output($)	17,928,088	3,881,071	4,686,795	26,495,953	1.48
Value Added($)	5,092,339	1,184,202	1,768,847	8,045,388	1.58
Labor Income($)	946,732	609,889	877,070	2,433,691	2.57
Jobs	41	27	36	105	2.53

[4] The total multiplier that is produced by our modeling system is called a Type "SAM" multiplier. It is driven primarily by assumptions about income growth and consumption in the industry and the region that we are studying. In previous studies, we used a multiplier that was called a Type II multiplier. The advantage of the Type "SAM" multiplier is that it measures transactions among households and other institutions as components of the economy under study and represents a more comprehensive description of linked economic activity in an area.

Table 4-4 (continued)
Estimated Economic Impacts of Iowa's Recycled Commodity Processing Industries (2007 Study)[1]

Glass	Direct	Indirect	Induced	Total[2]	Multiplier
Industrial Output($)[3]	2,305,071	789,488	559,535	3,654,094	1.59
Value Added($)	1,405,071	825,716	302,760	2,533,547	1.80
Labor Income($)	1,538,610	770,917	288,441	2,597,967	1.69
Jobs	77	39	14	129	1.69
Aluminum	**Direct**	**Indirect**	**Induced**	**Total[2]**	**Multiplier**
Industrial Output($)	25,531,670	6,816,749	4,455,801	36,804,220	1.44
Value Added($)	6,702,254	1,649,899	1,346,918	9,699,070	1.45
Labor Income($)	806,992	641,170	499,092	1,947,254	2.41
Jobs	27	21	16	63	2.39
All Other Metal	**Direct**	**Indirect**	**Induced**	**Total[2]**	**Multiplier**
Industrial Output($)	93,999,441	27,131,987	17,133,938	138,265,365	1.47
Value Added($)	28,802,350	10,056,386	7,803,499	46,662,235	1.62
Labor Income($)	7,033,621	6,041,449	4,543,346	17,618,417	2.50
Jobs	228	199	139	565	2.48
Wood Scrap	**Direct**	**Indirect**	**Induced**	**Total[2]**	**Multiplier**
Industrial Output($)	5,022,769	724,886	320,529	6,068,184	1.21
Value Added($)	6,074,846	2,056,671	1,089,570	9,221,088	1.52
Labor Income($)	4,477,106	1,922,780	1,012,479	7,412,364	1.66
Jobs	202	88	43	334	1.65
All Commodities	**Direct**	**Indirect**	**Induced**	**Total[2]**	**Multiplier**
Industrial Output($)	180,594,810	44,064,243	29,818,064	254,477,117	1.41
Value Added($)	74,974,504	22,287,401	17,581,434	114,843,339	1.53
Labor Income($)	29,720,560	15,628,902	11,729,887	57,079,348	1.92
Jobs	1,233	627	435	2,295	1.86

[1] All data is for calendar year 2005.
[2] Totals may not sum due to rounding.
[3] Industrial output for glass does not match the gross sales value in Table 4-2 as all of the other values do. This sector, owing to low prices, appears to not cover its costs; hence, the processing is done at a loss considering all factor inputs. This value represents the total estimated costs of production (or processing), not its receipts.

4.6.2 C&D Debris, Organics, Used Tires, and Electronics Processing

Table 4-5 provides totals for the C&D debris, organics, used tires, and electronics processing industries in Iowa. As was mentioned previously, the survey results did not give us a definitive characterization of the overall size of these activities in Iowa, especially on the processing side where the economic impacts are compiled. As in the 2001 study, we infer these sectors' activities from national statistics and used the following apportioning factors to characterize these sectors:

- C&D figures in Iowa are heavily weighted towards highway materials, so Iowa's share of all paved highways nationally was the apportioning factor;
- Organics were apportioned on a per capita basis;
- Tires were apportioned based on the state's share of registered trucks and automobiles; and
- The electronics allocation was based on total personal income shares as an approximation for expected household consumption.

Using the national statistics as our foundation, we can expect 68 jobs and $2.5 million in payroll for C&D activity in the state. Composting would require 316 jobs with $3.1 million in payroll. Electronics demanufacturing would need 38 jobs and $869,000 in payroll, and tire processing would require 58 jobs and $1.3 million in payroll.

Table 4-5
Estimates of C&D, Organics, Used Tires, and Electronics Processing Using National Shares
(2007 Study)

Industry	Nation[1]	Iowa
Pavement Mix Producers		
Employment	3,460	68
Annual Payroll	$ 135,936,000	$ 2,511,000
Estimated Receipts	$ 831,912,000	$18,742,000
Compost and Miscellaneous Organic Products		
Employment	31,718	316
Annual Payroll	$ 330,679,000	$ 3,079,000
Estimated Receipts	$ 1,905,971,000	$21,641,000
Computer and Electronic Appliance Demanufacturers		
Employment	3,837	38
Annual Payroll	$ 93,312,000	$ 869,000
Estimated Receipts	$ 435,509,000	$ 4,945,000
Tires		
Employment	3,917	58
Annual Payroll	$ 91,456,000	$ 1,274,000
Estimated Receipts	$ 377,434,000	$ 6,411,000

[1] Source: U.S. Recycling Economic Information (REI) Study, by R. W. Beck, Inc. for the National Recycling Coalition (NRC), 2001. The data was updated based on population growth since 2001.

We used the inferences in Table 4-5 as the foundation for estimating the potential economic impact of these industries displayed below in Table 4-6. Overall, C&D processing activities, considering all linkages and induced spending, would be expected to support $25.2 million in total industrial output that was produced by 135 jobs earning $5.8 million in labor income. The organic waste sector would produce $37.9 million in total output using 493 jobs making $18.3 million. Electronics processing would generate $7.8 million in total output from 67 jobs and nearly $2.0 million in labor income, and tire processing would generate $10.2 million in total output from 106 jobs and $2.0 million in labor income.

Table 4-6
Estimated Economic Impacts of Iowa's C&D, Organics, Used Tires, and Electronics Processing Industries
(2007 Study)[1]

Construction & Demolition	Direct	Indirect	Induced	Total[2]	Multiplier
Industrial Output($)	18,742,000	2,864,861	3,600,238	25,207,099	1.34
Value Added($)	4,544,000	1,470,337	2,050,514	8,064,851	1.77
Labor Income($)	3,744,000	984,497	1,089,463	5,817,960	1.55
Jobs	68	27	40	135	1.99
Organic Waste	**Direct**	**Indirect**	**Induced**	**Total[2]**	**Multiplier**
Industrial Output($)	21,641,000	4,617,849	11,676,725	37,935,576	1.75
Value Added($)	13,438,999	2,406,172	6,650,527	22,495,698	1.67
Labor Income($)	13,238,999	1,521,800	3,533,419	18,294,220	1.38
Jobs	316	46	131	493	1.56
Electronics	**Direct**	**Indirect**	**Induced**	**Total[2]**	**Multiplier**
Industrial Output($)	4,945,000	1,615,919	1,216,418	7,777,337	1.57
Value Added($)	1,900,412	844,441	692,808	3,437,661	1.81
Labor Income($)	1,130,841	494,024	368,101	1,992,966	1.76
Jobs	38	15	14	67	1.76
Tires	**Direct**	**Indirect**	**Induced**	**Total[2]**	**Multiplier**
Industrial Output($)	6,411,000	1,825,063	1,974,350	10,210,412	1.59
Value Added($)	1,499,181	590,788	715,687	2,805,656	1.87
Labor Income($)	1,274,000	357,720	380,250	2,011,970	1.58
Jobs	58	19	29	106	1.83

[1] All data is for calendar year 2005.
[2] Totals may not sum due to rounding.

4.6.3 Combined Recycled Commodity Processing Industry Impacts

The values in Tables 4-4 and 4-6 were combined to provide an estimate of the total size of Iowa's recycled commodity processing industries. These summaries are found below in Table 4-7. We estimate that Iowa's recycled commodity processors were responsible for $232.3 million in direct industrial output, 1,713 jobs, and $49.1 million in labor income. These industries required $55.0 million in production inputs from other Iowa firms, which in turn supported 735 jobs making nearly $19.0 million in labor income. When the direct and the indirect workers converted their salaries and wages to household spending, they induced another $48.3 million in output requiring 649 jobs and $17.1 million in labor income. In total, considering all processed commodities and linkages, recycling processing industries supported $335.6 million in total industrial output, from which $151.6 million in value added was realized, and 3,096 jobs were paid $85.2 million in labor incomes.

Table 4-7
Estimated Economic Impacts of All Recycled Commodity Processing in Iowa (2007 Study)[1]

All Commodities	Direct	Indirect	Induced	Total[2]	Multiplier
Industrial Output($)	232,333,810	54,987,935	48,285,795	335,607,542	1.44
Value Added($)	96,357,096	27,599,139	27,690,970	151,647,205	1.57
Labor Income($)	49,108,400	18,986,942	17,101,120	85,196,464	1.73
Jobs	1,713	735	649	3,096	1.81

[1] All data is for calendar year 2005.
[2] Totals may not sum due to rounding.

4.7 Iowa's Recycling Industry End-Users

There are several categories of industries in Iowa that are significant end-users of recycled commodities. Some industries continue to emerge, like plastics and re-manufacturing, while some have a long history in the state, like metals recovery and fabrication. Because these firms are able to purchase recycled commodities that are processed in Iowa, these purchases represent import substitutions and prevent the flow of dollars out of the state. In general, the stronger the linkages that are established between commodity processors and end-users in the state, the stronger the overall economic value of the specific industrial process to the state.

While the total amount of in-state purchases of recycled commodities can only be estimated, we can characterize the overall size and characteristics of these firms in the state. End-user types were constructed to align with the commodity processors: all other paper, old corrugated containers, plastics, all other metals, aluminum, and wood scrap. There were no glass end-users identified in the survey results.

Each of these industries was linked directly to the commodity supply that it purchases to more fully account for the amount and kind of transactions that are expected to occur between supplier and end-user. Each industry's regional purchasing coefficients for their primary inputs were adjusted to reflect the results of the survey regarding the amounts of commodities purchased in-state. Within these estimates, the overall values of the processing industries are subsumed, and they are considered indirect categories as inputs into the end-use production process. Additional secondary data provided by the Iowa Department of Workforce Development were used to determine the employment size of each industry.

Some caution should be used when describing these industries in total. The discrete assessments that we performed exclude measuring the degree to which these industries actually supply manufactured inputs to each other. As a consequence, the totals will reflect a minor amount of "double counting" in the indirect and the induced columns.

Overall, when we sum all of the employment in these firms in Table 4-8 below, we find 10,593 direct manufacturing jobs, $655.7 million in labor income ($61,897 per job), $939.4 million in value added, and $4.1 billion in direct industrial output. All of this direct activity works its way through the economy and supports 25,709 total jobs in the state, $1.15 billion in payments to labor, $1.81 billion in value added, and $5.65 billion in total industrial output.

Table 4-8
Summary of Estimated End-User Manufacturing Economic Values
(2007 Study)[1]

All Manufacturing End-Users	Direct	Indirect	Induced	Total[2]	Multiplier
Output($)	4,064,537,757	882,048,068	701,859,826	5,648,445,770	1.39
Value Added($)	939,365,397	473,222,768	399,795,684	1,812,383,897	1.93
Labor Income($)	655,676,815	281,472,233	212,395,080	1,149,544,119	1.75
Jobs	10,593	7,273	7,843	25,709	2.43

[1] All data is for calendar year 2005.
[2] Totals may not sum due to rounding.

Detail for all industries can be found below in Table 4-9. As is the case when conducting similar studies, the metal industry's values are much larger compared to the other commodities. Aluminum and all other metals manufacturing account for large fractions of direct and total jobs and industrial output. The next highest category is "All Other Paper", which accounts for nearly 4,700 jobs and almost $900 million in total output.

Table 4-9
Detailed Manufacturing End-User Estimated Economic Values
(2007 Study)[1]

Old Corrugated Containers	Direct	Indirect	Induced	Total[2]	Multiplier
Output ($)	135,444,992	58,262,500	24,854,918	218,562,416	1.61
Value Added ($)	29,196,480	27,191,770	14,158,061	70,546,312	2.42
Labor Income ($)	17,587,762	15,467,390	7,521,443	40,576,596	2.31
Jobs	265	410	278	952	3.59
All Other Paper	**Direct**	**Indirect**	**Induced**	**Total[2]**	**Multiplier**
Output ($)	641,472,256	121,904,000	130,463,592	893,839,872	1.39
Value Added ($)	153,648,624	65,504,112	74,316,480	293,469,216	1.91
Labor Income ($)	134,795,520	39,905,128	39,479,616	214,180,256	1.59
Jobs	2,250	989	1,458	4,697	2.09
Plastics	**Direct**	**Indirect**	**Induced**	**Total[2]**	**Multiplier**
Output ($)	253,376,416	66,147,388	58,955,692	378,479,488	1.49
Value Added ($)	101,657,600	32,526,342	33,583,116	167,767,056	1.65
Labor Income ($)	60,052,632	19,218,358	17,840,636	97,111,624	1.62
Jobs	1,431	478	659	2,568	1.79
Aluminum	**Direct**	**Indirect**	**Induced**	**Total[2]**	**Multiplier**
Output ($)	2,390,555,136	444,905,568	293,148,480	3,128,609,280	1.31
Value Added ($)	386,617,440	246,503,536	166,981,840	800,102,848	2.07
Labor Income ($)	245,414,992	144,690,384	88,713,512	478,818,880	1.95
Jobs	3,067	3,695	3,276	10,038	3.27
All Other Metal	**Direct**	**Indirect**	**Induced**	**Total[2]**	**Multiplier**
Output ($)	566,559,680	174,408,048	171,872,016	912,839,744	1.61
Value Added ($)	221,803,760	93,463,008	97,902,336	413,169,120	1.86
Labor Income ($)	172,233,280	57,576,056	52,011,424	281,820,768	1.64
Jobs	3,093	1,577	1,921	6,591	2.13
Wood	**Direct**	**Indirect**	**Induced**	**Total[2]**	**Multiplier**
Output ($)	77,129,277	16,420,564	22,565,128	116,114,970	1.51
Value Added ($)	46,441,493	8,034,000	12,853,851	67,329,345	1.45
Labor Income ($)	25,592,629	4,614,917	6,828,449	37,035,995	1.45
Jobs	487	124	252	863	1.77

[1] All data is for calendar year 2005.
[2] Totals may not sum due to rounding.

4.8 Iowa's Remanufacturing and Reuse Sectors

Table 4-10 below lists the economic values for all remanufacturing and reuse industries in Iowa. These businesses repair and re-sell used commodities or re-usable items. The industries assessed include wood reuse, computer and peripheral repair, motor vehicle parts, tire retreading, and used goods retail. All of these industries accounted for $272.5 million in direct output requiring 2,855 jobs earning $68.4 million in labor income. These industries also linked very strongly with the Iowa economy by requiring $88.7 million in indirect inputs, which required 723 jobs and $25.1 million in labor income. When the direct and the indirect workers converted their wages and salaries into household incomes, they induced $70.2 million in additional sales in the state, 785 more jobs, and $21.3 million in labor income. All together, remanufacturing and reuse accounted for $431.5 million in output, $187.8 million in value added, 114.8 million total labor incomes, and 4,363 jobs.

Table 4-10
Estimated Economic Impacts of Remanufacturing and Reuse Industries
(2007 Study)[1]

Wood Reuse	Direct	Indirect	Induced	Total[2]	Multiplier
Output($)	129,128,904	58,818,828	27,481,570	215,429,296	1.67
Value Added($)	27,855,066	25,717,046	15,652,061	69,224,176	2.49
Labor Income($)	21,777,810	14,922,062	8,316,222	45,016,096	2.07
Jobs	851	417	307	1,576	1.85
Tire Retreading	**Direct**	**Indirect**	**Induced**	**Total[2]**	**Multiplier**
Output($)	34,189,901	7,330,716	6,526,961	48,047,578	1.41
Value Added($)	8,697,182	3,798,919	3,717,974	16,214,074	1.86
Labor Income($)	6,341,102	2,328,881	1,975,131	10,645,115	1.68
Jobs	143	58	73	274	1.92
Used Motor Vehicle Parts	**Direct**	**Indirect**	**Induced**	**Total[2]**	**Multiplier**
Output($)	42,152,266	11,231,362	13,128,743	66,512,371	1.58
Value Added($)	24,868,338	6,393,140	7,478,576	38,740,054	1.56
Labor Income($)	13,672,634	4,044,689	3,972,890	21,690,214	1.59
Jobs	409	126	147	681	1.67
Retail Used Goods	**Direct**	**Indirect**	**Induced**	**Total[2]**	**Multiplier**
Output($)	29,723,733	5,038,951	12,489,492	47,252,176	1.59
Value Added($)	21,911,555	2,874,114	7,114,460	31,900,129	1.46
Labor Income($)	14,727,365	1,738,743	3,779,421	20,245,529	1.37
Jobs	1,160	55	140	1,354	1.17
Computer and Peripheral Reuse and Repair	**Direct**	**Indirect**	**Induced**	**Total[2]**	**Multiplier**
Output($)	37,308,816	6,292,643	10,621,908	54,223,368	1.45
Value Added($)	22,332,910	3,345,156	6,049,700	31,727,764	1.42
Labor Income($)	11,884,570	2,110,659	3,214,286	17,209,516	1.45
Jobs	292	67	119	478	1.64
Total Reuse and Remanufacturing	**Direct**	**Indirect**	**Induced**	**Total[2]**	**Multiplier**
Output($)	272,503,619	88,712,500	70,248,674	431,464,789	1.58
Value Added($)	105,665,050	42,128,375	40,012,771	187,806,197	1.78
Labor Income($)	68,403,481	25,145,034	21,257,951	114,806,469	1.68
Jobs	2,855	723	785	4,363	1.53

[1] All data is for calendar year 2005. Source of data: Iowa Department of Workforce Development and the U.S. Census Bureau. R. W. Beck quantified the economic activity of remanufacturing and reuse industries by combining existing economic data with data from the U.S. Census Bureau's economic census of U.S. businesses.
[2] Totals may not sum due to rounding.

4.9 Export Sales of Collected Recyclable Materials

Iowa's collectors of recycled commodities had export sales that were valued at $20.5 million. Sales to exports constitute the allocation of a commodity to final demand and can be considered an economic impact. Those sales were run through the I-O model used for this exercise. The findings are contained below in Table 4-11. The economic impacts of exports were not characterized in the previous studies.

Collection export sales required 76 jobs earning $2.26 million in labor income. In so doing, Iowa's collectors required $3.2 million in inputs further stimulating 31 jobs and $.983 million in labor income. When workers in the direct and the indirect industries converted their wages and salaries into household consumption, they induced another $2.4 million in output requiring 27 jobs and $.732 million in labor income. In all, the economic impact of exported collections yielded $26.1 million in industrial output, $6.85 million in state value added, $3.97 million in labor income, and 133 jobs.

Table 4-11
Estimated Collection Export Sales Economic Impacts
(2007 Study)[1]

Collection Export Sales	Direct	Indirect	Induced	Total[2]	Multiplier
Output($)	20,483,107	3,216,447	2,421,622	26,121,177	1.28
Value Added($)	3,790,716	1,681,672	1,379,438	6,851,826	1.81
Labor Income($)	2,255,666	983,499	732,807	3,971,973	1.76
Jobs	76	31	27	133	1.76

[1] All data is for calendar year 2005.
[2] Totals may not sum due to rounding.

4.10 Recycling Equipment Manufacturers Economic Values

Recycling equipment manufacturers in Iowa were also surveyed, however because the number of completed surveys returned was limited, economic data for manufacturers of recycling equipment compiled by the Iowa Department of Natural Resources were used as a surrogate for the analysis. These data were summarized by industrial code and the estimated employment in these firms was entered into the I-O model to determine the production characteristics of this component of Iowa's recycling industrial matrix.

Recycling equipment includes the containers, processing equipment, and the vehicles necessary to collect or process recyclable products. As shown in Table 4-12, we estimated that Iowa firms that manufacture these types of goods directly employed 523 workers, paid $27.1 million in labor income, and produced $106.6 million in industrial output. As those activities worked their way through the Iowa economy, we estimated that 994 total jobs were sustained by this sector, $42.2 million in labor incomes were supported, and total industrial output was $154.7 million. While a portion of the demand for recycling equipment sales originate within the state, a large fraction of the total demand likely comes from out-of-state. Consequently, these firms generate sales for export and are thus considered a part of Iowa's industrial base.

Table 4-12
Estimated Recycling Equipment Manufacturers Economic Values
(2007 Study)[1]

Totals	Direct	Indirect	Induced	Total[2]	Multiplier
Industrial Output($)	106,577,805	22,418,962	25,667,610	154,664,377	1.45
Value Added($)	35,904,400	11,922,702	14,618,915	62,446,017	1.74
Labor Income($)	27,094,544	7,328,191	7,767,316	42,190,051	1.56
Jobs	523	184	287	994	1.90

[1] All data is for calendar year 2005.
[2] Totals may not sum due to rounding.

4.11 Summary

Overall, in 2005, the Iowa recycling industry economic values reflected the following:

- More than $159 million in commodity gross receipts;
- 1,713 direct processing jobs and 3,096 in total recycling-related processing jobs (including C&D, organics, used tires, and electronics);
- 10,593 in direct end-use recycling industry jobs and more than $4 billion in direct industrial output;
- The remanufacturing and reuse industry, in itself, provides more than $431 million in total output and 4,363 jobs;
- The recycling equipment industry, provides more than $154 million in total industrial output and 994 total jobs;
- For every 100 jobs created in the recycling processing industry, 81 additional jobs are sustained in the Iowa economy; and
- For every dollar in labor income created in the recycling processing industry, $0.73 of additional income is sustained in the Iowa economy.

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Section 5
FISCAL IMPACTS ANALYSIS

5.1 Overview

When conducting an analysis of the economic values of specific kinds of industrial activity in a region or a state, it is instructive to look at the impacts of industrial change and growth on the flow of revenues into local governments and state governments. State and local governments are an intrinsic component of a regional or state economy, and we can measure the economic outcomes to local and state government operations using fiscal impact modeling.

Overall, these models are designed to use the findings of an input-output assessment to translate the job and income growth into household impacts, and then analyze those changes within the context of local government operations and state government receipts. Thus, for purposes of this Study, the jobs and income findings of the economic impacts analysis for recyclable materials processing, end-use, and remanufacturing, as well as equipment manufacturing were used to estimate the projected fiscal outcomes for these specific recycling activities.

5.2 Methodology

Fiscal impacts are estimated for Iowa's urban counties (its 20 metropolitan counties) and its rural counties (its 79 non-metropolitan counties)[1]. In this analysis, the processor and the end-use jobs were apportioned by the statewide distribution of manufacturing jobs in Iowa. The equipment manufacturers were compiled without differentiating among urban and rural counties; only state totals are reported.

[1] Metropolitan counties consist of counties with a core central city of 50,000 or more and all counties with which they have a strong flow of incommuters. In 1990, Iowa had eight primary metropolitan counties with one of the areas consisting of three counties for a total of ten Metropolitan Statistical Area counties. In 2000, the state added a metropolitan county and nine other counties were determined to be otherwise linked to Iowa's metropolitan areas for a total of 20 urban (or metropolitan statistical area) counties.

The findings first isolate all local government own-source revenues – taxes, charges, and fees that are generated from their local population[2], by source of that revenue, and local government direct expenditures by major function. Local schools, municipalities, and county governments account for the vast majority of local government receipts and spending. Comparatively minor amounts of revenues and spending are attributable to townships and special districts.

All households demand a mix of public services that can be estimated. To fund these service demands, we isolated an expected flow of revenues based on expected income and households. When economies grow, their local government revenues typically grow along with service demands. Larger, more urban economies have generally higher incomes and require a more extended set of public services.

In this analysis for the local and state government activities, we only estimated their own-source revenues. Governments receive revenues from other governments. The federal government underwrites a large amount of state government activity, and state government contributes strongly towards the funding of local government activities, most notably for local schools and for highways. The sum of government own-source receipts plus all net transfers in from other governments equals their general revenues. In previous studies, using a different modeling system, we simulated inter-governmental transfers. In this analysis, however, we do not account for transfers and just measure own-source revenue generation. Increasingly, local government officials are much more interested in the relationship between economic activity and own-source receipts, recognizing that local and state governments must annually balance their budgets, spending must equal receipts. The use of own-source revenues impact summaries allows for a preliminary benchmark for gauging the marginal change in local or state government resources attributable to measured economic change.

The accompanying tables simply present the local own-source revenues and direct spending estimates for the local governments and for the state as a whole for the categories for which economic values were calculated: recycling processors, end-users, remanufacturing and reuse businesses, the export value of collection activity, and equipment manufacturers. There is no reconciliation of revenues and expenditures in this assessment or tracking of inter-governmental revenue flows. The tables below present the government finance values that would be expected given the jobs and the incomes that are supported in the recycling economy that we measured.

[2] In the 2001 study, the Iowa Economic and Fiscal Impact model was used to estimate government receipts and costs. That model was built using benchmark fiscal 1997 government finances data and results were driven by expectations of local population growth stimulated by employment changes. It would be inappropriate to apply it to this exercise. A different model was constructed for this project using current government finance data. This model has been built to align with economic impact summaries in Iowa, and it is driven by estimates of income growth in Iowa or its sub-regions. The model produces estimates of own-source revenues and of all direct spending for state and local governments in Iowa (albeit, only own-source receipts are reported in this study). This newer model does not track intergovernmental revenue flows; hence, the results of this fiscal analysis are not easily compared to the previous study. A summary of own-source tax revenues comparing the two periods is presented in a following section so that readers can translate economic impact-related information and changes into fiscal impact outcomes over the two study time periods.

5.3 Fiscal Impacts of Recyclable Materials Processing

The data that were compiled in the economic impacts analysis were used to estimate local and state government fiscal outcomes that are generated by recyclable materials processing in the state. This estimate refers to all of the original processing sectors assessed in this study – paper, plastics, glass, metals, and wood, along with organic wastes, C&D debris, used tires, and electronics. These findings are depicted below in Table 5-1.

Table 5-1
Estimated Fiscal Impacts Associated with Recyclable Materials Processing In Iowa (2007 Study)[1,2]

General Revenue from Own Sources	Local Government			State Government		
	Urban	Rural	Total	Urban	Rural	Total
Taxes	1,681,224	1,905,770	3,586,994	2,445,000	2,771,556	5,216,556
Property[3]	1,404,027	1,591,550	2,995,577	-	-	-
Sales and gross receipts	224,403	254,375	478,778	1,117,116	1,266,319	2,383,435
Individual income	24,996	28,335	53,331	958,381	1,086,383	2,044,763
Corporate income	-	-	-	79,281	89,870	169,151
Motor vehicle license	6,769	7,673	14,442	162,574	184,288	346,862
Other taxes	21,029	23,838	44,867	127,648	144,697	272,344
Current charges	890,143	1,009,031	1,899,174	795,882	902,181	1,698,063
Miscellaneous	223,380	253,214	476,594	359,648	407,683	767,330
Total General Revenue from Own Sources ($)	2,794,747	3,168,016	5,962,762	3,600,530	4,081,420	7,681,950

[1] Data is in 2005 dollars.
[2] Totals may not sum due to rounding.
[3] The fiscal impacts of Iowa's recycling property tax exemption are estimated to be minimal and thus, were not accounted for in this analysis.

Own-source receipts to all local governments in urban/metropolitan counties (i.e., metropolitan statistical area) that are attributable to the economic activity of processing commodities for recycling in Iowa are estimated to generate $2.8 million, $1.4 million of which would be in property taxes. Rural area local government own-source revenue receipts amount to $3.2 million, $1.6 million of which are property taxes. Total estimated own-source revenues supported by the commodity processing firms and their total employment in Iowa would be $5.96 million. In all, recyclable materials processing supports $7.7 million in state own-source revenues, $5.2 million of which are from taxes.

5.4 Fiscal Impacts of End-Use Manufacturing

From the economic impacts analysis, we projected that all estimated end-use manufacturing in Iowa sustained 25,709 jobs and generated nearly $1.15 billion in labor income. Those jobs and incomes can be used to estimate the local and state government fiscal impacts, as depicted below in Table 5-2.

As the employment and the income numbers are large, the amounts of local and state receipts are also large. The local governments in urban counties would yield $37.7 million in own-source revenues, of which $18.9 million would be property taxes. The rural counties would generate nearly $42.7 million in own-source revenues, $21.5 million of which would be property taxes. Combined, end-use manufacturing employment in Iowa is expected to sustain $80.5 million in local government own-source revenues, of which $40.4 million are property taxes. State receipts are substantial, too. Iowa's own-source revenues driven by end-use economic impact incomes would be $103.7 million, $70.4 million of which would be taxes.

Table 5-2
Estimated Fiscal Impacts Associated with End-Use Manufacturing In Iowa
(2007 Study)[1,2]

General Revenue from Own Sources	Local Government			State Government		
	Urban	Rural	Total	Urban	Rural	Total
Taxes	22,684,527	25,714,293	48,398,819	32,990,046	37,396,227	70,386,273
Property[3]	18,944,341	21,474,564	40,418,905	-	-	-
Sales and gross receipts	3,027,839	3,432,240	6,460,080	15,073,092	17,086,268	32,159,361
Individual income	337,271	382,317	719,587	12,931,297	14,658,413	27,589,711
Corporate income	-	-	-	1,069,730	1,212,604	2,282,334
Motor vehicle license	91,335	103,534	194,869	2,193,592	2,486,571	4,680,163
Other taxes	283,741	321,637	605,378	1,722,334	1,952,370	3,674,704
Current charges	12,010,574	13,614,717	25,625,292	10,738,726	12,173,000	22,911,726
Miscellaneous	3,014,031	3,416,588	6,430,619	4,852,678	5,500,806	10,353,484
Total General Revenue from Own Sources ($)	37,709,132	42,745,598	80,454,730	48,581,450	55,070,033	103,651,483

[1] Data is in 2005 dollars.
[2] Totals may not sum due to rounding.
[3] The fiscal impacts of Iowa's recycling property tax exemption were minimal and thus, were not accounted for in this analysis.

5.5 Fiscal Impacts of Remanufacturing and Reuse Industries

Wood product reuse, computer and peripheral repair and reuse, used motor vehicle parts, used retail goods, and tire retreading in Iowa supported 4,363 jobs and nearly $115 million in labor incomes. Those economic levels resulted in the expected government receipts displayed below in Table 5-3.

For urban areas, these Iowa establishments supported $3.8 million in local government own-sources of revenues, of which $1.9 million were property taxes. For the rural areas, $4.3 million in receipts were raised, of which $2.1 million were property taxes. State own-source receipts were $10.4 million, of which $7.0 million were taxes.

Table 5-3
Estimated Fiscal Impacts Associated with Remanufacturing and Reuse Industries In Iowa (2007 Study)[1,2]

General Revenue from Own Sources	Local Government			State Government		
	Urban	Rural	Total	Urban	Rural	Total
Taxes	2,265,533	2,568,120	4,833,653	3,294,759	3,734,810	7,029,569
Property[3]	1,891,996	2,144,693	4,036,689	-	-	-
Sales and gross receipts	302,394	342,782	645,177	1,505,369	1,706,428	3,211,797
Individual income	33,684	38,182	71,866	1,291,466	1,463,955	2,755,420
Corporate income	-	-	-	106,835	121,104	227,940
Motor vehicle license	9,122	10,340	19,462	219,077	248,337	467,414
Other taxes	28,338	32,122	60,460	172,012	194,986	366,997
Current charges	1,199,512	1,359,720	2,559,231	1,072,491	1,215,733	2,288,224
Miscellaneous	301,015	341,219	642,234	484,643	549,373	1,034,016
Total General Revenue from Own Sources ($)	3,766,060	4,269,059	8,035,119	4,851,893	5,499,916	10,351,809

[1] Data is in 2005 dollars.
[2] Totals may not sum due to rounding.
[3] The fiscal impacts of Iowa's recycling property tax exemption were minimal and thus, were not accounted for in this analysis.

5.6 Fiscal Impacts of Recycling Equipment Manufacturing

In the equipment manufacturer economic impact section, we identified a total of 994 jobs and $42.2 million in labor incomes that are attributable to Iowa firms that manufacture equipment for the recycling industry. Because the number of these firms is relatively small and localized, we are only reporting the local and state government total amounts in Table 5-4 without an urban and rural breakdown.

We estimate approximately $2.95 million in local government own-source receipts, $1.5 million of which would come from property taxes. State own-sources would be $3.8 million, $2.6 million of which would be in the form of total taxes.

Table 5-4
Estimated Fiscal Impacts Associated with Recycling Equipment Manufacturing In Iowa (2007 Study)[1,2]

General Revenue from Own Sources	Local Government	State Government
Taxes	1,776,312	2,583,285
Property[3]	1,483,436	-
Sales and gross receipts	237,095	1,180,298
Individual income	26,410	1,012,585
Corporate income	-	83,765
Motor vehicle license	7,152	171,769
Other taxes	22,218	134,867
Current charges	940,488	840,896
Miscellaneous	236,014	379,989
Total General Revenue from Own Sources	$2,952,813	$3,804,170

[1] Data is in 2005 dollars.
[2] Totals may not sum due to rounding.
[3] The fiscal impacts of Iowa's recycling property tax exemption were minimal and thus, were not accounted for in this analysis.

5.7 Fiscal Impacts of Collection Export Sales Activity

In this Study, we have estimated that export sales by Iowa collectors constitutes an economic impact in that those sales are going to a final demand external to the state economy and are therefore resulting in an in-flow of funds into Iowa.

Table 5-5 shows that this activity would support $277,992 in local government own-source receipts, of which $139,658 would be property taxes. State receipts would be $358,143, and $243,203 would be from taxes. The fiscal impacts from this activity were not included in previous studies.

Table 5-5
Estimated Fiscal Impacts Associated with Recycling Collection Export Sales In Iowa (2007 Study)[1,2]

General Revenue from Own Sources	Local Government	State Government
Taxes	167,230	243,203
Property[3]	139,658	-
Sales and gross receipts	22,321	111,119
Individual income	2,486	95,330
Corporate income	-	7,886
Motor vehicle license	673	16,171
Other taxes	2,092	12,697
Current charges	88,542	79,166
Miscellaneous	22,219	35,774
Total General Revenue from Own Sources	$277,992	$358,143

[1] Data is in 2005 dollars.
[2] Totals may not sum due to rounding.
[3] The fiscal impacts of Iowa's recycling property tax exemption were minimal and thus, were not accounted for in this analysis.

5.8 Summary

The comparisons of the fiscal impacts of the processing, end-use, and remanufacturing/reuse industries in Iowa, reflect the following:

- End-use fiscal impacts, measured using revenues from own-sources and property taxes, greatly exceed the fiscal impacts for all of the other recycling activities combined.
- The remanufacturing and reuse industry's fiscal impacts exceed the fiscal impacts for the processing industry.

If the fiscal benefits to state and local governments are factored into the analysis, the net benefits are substantial. Specifically, Tables 5-1 through 5-3 (processing, end-use, and remanufacturing/reuse) identify local governmental revenues resulting from Iowa's recycling industry to be $94.5 million and state revenues to be $121.7 million. The local benefits include $5.96 million attributed to recyclable materials processing, $80.5 million attributed to end-use manufacturing, and $8.0 million attributed to remanufacturing and reuse. The statewide benefits include $7.7 million attributed to recyclable materials processing, $103.7 million attributed to end-use manufacturing, and $10.4 million attributed to remanufacturing and reuse.

Most interestingly, when the results are aggregated into urban and rural sectors, the fiscal impacts to the rural sector are higher than the urban fiscal impacts in each of the three main industries – processing, end-use, and remanufacturing/reuse.

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Section 6
COMPARISON OF THE 2001 STUDY AND 2007 STUDY IMPACTS

6.1 Overview

This section compares the major findings of the 2001 Economic Impacts of Recycling in Iowa Study (2001 Study) with the current Study.

As in the previous study in which we compared two study results, there have been changes in the recycling industry, changes in how the nation characterizes recycling activities, changes in our computing technology and our approaches to measuring the Iowa recycling industry. These changes can make it difficult to compare the studies. The current Study and the 2001 Study used survey data of materials collectors, processors, end-users, remanufacturers, reuse industries, and recycling equipment manufacturers as the basis for the analyses. However, in some instances, the Project Team and IDNR representatives were required to use their expert judgments to fill some of the data gaps to effectively complete the analysis.

6.2 Methodology

Comparisons of the two periods were influenced in part by two factors. First, the U.S. changed its industrial accounting system from the Standard Industrial Classification (SIC) system to the North American Industrial Classification System (NAICS) format. This means that the scope of all inter-industrial transactions in our modeling system has changed. There is more precision in some parts, especially in industries that have emerged in the past 20 years, and less precision in other parts, like agriculture for example.

A second change concerns the compilation of the relevant "total" multiplier. A multiplier is a measure that represents the value of a change in the industry being analyzed. For example, a jobs multiplier of 1.25 means that for every 100 jobs directly created in the recycling industry, 25 additional jobs are created in supporting industries. Likewise, an income multiplier of $1.50 means that for every $1.00 of income created directly though the recycling industry, an additional $.50 of income is created in supporting industries.

For the 2001 Study data, we used a multiplier from our modeling system called a Type II multiplier. In the newer, updated modeling system, the multiplier is referred to as a social account matrix, or SAM multiplier. The SAM multiplier is preferred within the economic modeling industry because it includes the contributions of households as industries and exchangers of production goods and services when calculating economic impacts. Both multipliers, though relevant for their time period, are labeled as total multipliers.

For our comparison, only the multipliers for jobs are compared. The output multiplier varies strongly from year to year, depending on the overall prices of inputs or the prices received for the commodity under study. This may have little effect on overall labor incomes and jobs. The 2001 Study isolated total income, which was the combination of labor earnings and return on investment. In this Study, we isolated only labor income because it provides a better reflection of the kind of incomes that are made by workers and by sole proprietors which is likely to remain in and be re-spent in the local economy. Consequently, the value added multipliers are not comparable.

Overall, comparing multipliers over time can be problematic. Industries may continuously introduce technology that reduces their direct demand for labor. Depending on the kind of inputs the industry will require and the overall expected pay received by employees, over a reasonable period of time job multipliers might increase or decrease markedly. Still, for the study purposes we have compared the jobs multipliers as they tend to have relevance for policy makers.

6.3 Study Comparison

At the outset, there are two economic factors that are different in the current Study than in the 2001 Study. They include the following:

- Prices paid for most commodities have changed; and
- The modeling system and its underlying foundation data have been modified and improved.

Table 6-1 shows the summaries of processed commodities and receipts and displays the major changes as related to the two factors listed above. There are some substantial differences in the amounts of commodities collected by material category, the amounts received per ton, and the overall gross output of Iowa’s recycling processing industry. The data in this table are not adjusted for inflationary changes, but during the 1999 to 2005 period, consumer prices rose by 17 percent.

Table 6-1
Comparison of the 2001 Study and 2007 Study Estimated Recyclable Materials Processed and Receipts[1,2]

Material Types	2001 Study (1999 data)		2007 Study (2005 data)[3]				
	All Suppliers (Tons)	Expected Gross Receipts	All Suppliers (Tons)	Expected Gross Receipts	Pct. Change in Tons	Pct. Change in Receipts	Pct. Change $ Per Ton
All Paper	341,691	27,694,753	581,628	36,987,435	70%	34%	-22%
OCC	163,865	9,720,018	156,891	11,296,117	-4%	16%	21%
All Other Paper	177,826	17,974,735	424,737	25,691,318	139%	43%	-40%
Plastics	29,724	3,665,062	48,916	17,928,088	65%	389%	197%
Glass	47,409	1,386,288	63,499	1,125,407	34%	-19%	-39%
All Metals	608,627	71,565,587	239,353	119,531,111	-61%	67%	325%
Alum Cans	7,058	6,838,794	22,010	25,531,670	212%	273%	20%
All Other Metal	601,569	64,726,793	217,343	93,999,441	-64%	45%	302%
Wood Wastes	103,194	8,977,906	193,183	5,022,769	87%	-44%	-70%
Total Quantity	1,130,646	$113,289,596	1,126,579	$180,594,810	0%	59%	60%

[1] All data is for calendar years 1999 and 2005.
[2] Totals may not sum due to rounding.
[3] Source: Table 4-2 of this report.

One noticeable difference is in the estimate of the amount of processed commodities. The amount processed in 2005 is just slightly less than estimated in 1999. Only one material category had a noticeable decrease in tons since the last study and that was the metals, excluding aluminum cans. This could be attributed to the difference in surveys returned for this Study compared to the 2001 Study. (The survey totals, by commodity, were assumed representative of the distribution of processing activities in Iowa and used as a basis to calculate statewide totals.) Not all of the metals recycling businesses that responded to the 2001 Study survey, responded to the current Study survey.

Receipts, however, are much higher. On a gross, before inflation basis, they were 59 percent higher, and on a weighted-average basis per commodity ton they were 60 percent higher. Paper processing grew by 70 percent, plastics by 65 percent, but all metals were 61 percent lower. Aluminum processing gained more than twice as much tonnage, and wood wastes an estimated 87 percent more. Overall receipts to paper processors increased even though lower prices per ton were received, while plastics receipts appreciated sharply on both total receipts and on a price per ton basis. The prices received for metals processing were high, gaining 67 percent in total, led strongly by gains in the prices received for all other non-ferrous metals.

Next we compared the estimated total economic values of the processors. The direct commodity values in Table 6-2 align with the expected gross receipts that were just presented in Table 6-1. Table 6-2 below provides the direct values, the total values considering all multiplied-through considerations, and the total multiplier value for jobs.

Table 6-2
Comparison of the 2001 Study and 2007 Study Estimated Processor Economic Values

	2001 Study (1999 Processors)			2007 Study (2005 Processors)		
	Direct	Total	Multiplier	Direct	Total	Multiplier
OCC						
Industrial Output($)	9,720,018	16,246,095		11,296,117	13,956,398	
Value Added($)	4,211,020	7,949,224		7,746,271	11,490,011	
Jobs	163	254	1.55	181	315	1.74
All Other Paper						
Industrial Output($)	17,974,735	29,694,089		25,691,318	30,912,567	
Value Added($)	6,637,412	13,330,311		18,651,373	26,691,999	
Jobs	206	367	1.78	478	784	1.64
Plastics						
Industrial Output($)	3,665,062	5,514,626		17,928,088	26,495,953	
Value Added($)	866,208	1,912,058		5,092,339	8,045,388	
Jobs	34	59	1.73	41	105	2.53
Glass						
Industrial Output($)[1]	1,386,288	2,566,399		2,305,071	3,654,094	
Value Added($)	1,088,855	1,778,998		1,905,071	3,033,548	
Jobs	40	57	1.42	77	129	1.69
Aluminum						
Industrial Output($)	6,838,794	9,781,220		25,531,670	36,804,220	
Value Added($)	1,030,635	2,673,364		6,702,254	9,699,070	
Jobs	42	81	1.91	27	63	2.39
All Other Metal						
Industrial Output($)	64,726,793	102,115,423		93,999,441	138,265,365	
Value Added($)	18,875,302	40,113,389		28,802,350	46,662,235	
Jobs	665	1,175	1.77	228	565	2.48
Wood						
Industrial Output($)	8,977,906	14,359,019		5,022,769	6,068,184	
Value Added($)	2,658,061	5,702,088		6,074,846	9,221,088	
Jobs	119	192	1.61	202	334	1.65
All Commodity Processors[2]						
Industrial Output($)[1]	113,289,596	180,276,872		181,774,474	256,156,781	
Value Added($)	35,367,494	73,459,432		74,974,504	114,843,339	
Jobs	1,271	2,185	1.72	1,234	2,295	1.86

[1] The 2005 industrial output for glass does not match the gross receipts in Table 6-1 as all of the other values do. This sector, owing to low prices, appears to not cover its costs without some subsidies. This value represents the total estimated costs of production (or processing), not its receipts. This effects the 2005 All Commodity Processors' direct output total as well.
[2] Totals may not sum due to rounding.

This comparison to the 2001 Study, considers paper, plastics, glass, metals and wood processing only. The estimated total industrial output economic values increased to $256.2 million from $180.3 million in 1999. Value added total economic effects also appreciated from $73.5 million to an estimated $114.8 million. The estimated direct jobs declined slightly to 1,234 from 1,271, and the total jobs estimated to be supported by recyclable materials processing increased from 2,185 to 2,295.

The total job impact is greater because of induced economic activity. The generally higher prices paid for recyclable materials commodities in 2005 translates into higher earnings for workers and for owner/operators of processing operations. They in turn re-spend at greater levels in the state economy.

Old corrugated containers and wood processing reflected strong declines in total output effects, although the overall total job impact changes were up slightly for OCC processing. Wood processing was estimated to require more labor owing to a sharp increase in tonnage processed. Plastics reflected strong increases in value added, output, and in the total number of jobs.

The all other metals processing component saw total output impacts increase from $102.1 million in 1999 to $138.3 million in 2005, but the estimated job requirements declined sharply. Aluminum reflected gains in total output and value added, but owing to the allocation of all processing jobs relative to tonnage processed, declined in the total job effects.

6.4 Fiscal Impact Comparisons

The fiscal impact comparisons are presented below. Fiscal impact comparisons over time are influenced by overall governmental behavior, tax policies, and other broader economic and social factors. Much of the 1990s represented an era of expanded state and federal government activities. Towards the end of that period, state governments (Iowa among them), reduced their personal and corporate income tax rates and shifted more of government revenue generation into sales and use taxes. Local governments in Iowa also shifted their revenue emphases away from property taxes to local option sales taxes and to user charges and other service fees. Accordingly, the governmental revenue of Iowa state and local governments have changed.

This assessment uses a different modeling approach that is geared towards isolating own-source revenues (taxes, charges, and other miscellaneous sources) and does not estimate inter-governmental transfers. In order to align the comparisons over the two time periods on a standards basis, the accompanying tables compare tax collection changes for local and state governments over the respective relevant periods.

In Tables 6-3 and 6-4, we compare local and state government tax collections for the recycling commodity processors and the end-users, as these two groupings can be standardized over the two study periods. Again, the data are not adjusted for inflation, but consumer prices increased by 17 percent over the measurement period.

Table 6-3 compares the fiscal impacts for recyclable materials processing and excludes organic waste, construction and demolition debris, used tires, and electronics to keep the two studies' commodity groupings the same[1]. Estimated local government tax collections declined by 7 percent although other taxes, primarily local option sales tax receipts, are estimated to have increased by 54 percent. Total state government tax receipts are estimated to have increased 26 percent. Personal income taxes declined, but sales and gross receipts taxes increased by 69 percent and all other taxes by 68 percent. Combined, we estimated that the local and state taxes generated by the recycling commodity economic activity increased by 10 percent.

Table 6-3
Recyclable Materials Processors Estimated Fiscal Impact Comparisons, 1999 and 2005

Selected Local Government Receipts	1999	2005	Percentage Change
Total Local Taxes	$2,578,642	$2,403,190	-7%
Property Taxes	2,320,575	2,006,956	-14%
Other Taxes	258,067	396,234	54%
Total State Taxes	2,772,005	3,494,953	26%
Personal Income Tax	1,388,343	1,369,937	-1%
Sales and Gross Receipts Taxes	945,014	1,596,838	69%
Corporation Taxes	191,187	113,327	-41%
Other Taxes	247,461	414,851	68%
Combined State and Local Taxes	$5,350,647	$5,898,143	10%

Table 6-4 summarizes the fiscal impacts of end-users. These values are quite large as Iowa's end-users represent a sizeable amount of the state's manufacturing capacity. The total incomes that are estimated from all end-use economic impacts are expected to support $48.85 million in local government taxes. This represents a 51 percent increase from the estimate made in 1999. Expected tax receipts to state government would be $71.04 million, up by 18 percent over the earlier period. Again this growth is driven by strong shifts into sales and gross receipts taxes and all other taxes. Overall, we estimated the amount of combined total state and local tax receipts generated increased by 29 percent between 1999 and 2005.

[1] The 2005 numbers in Tables 5-1 and 5-2 of the Fiscal Impacts Analysis of this Study are different than those shown in Tables 6-3 and 6-4 of the Comparison section because in Section 5, the fiscal impacts included organics, C&D, used tires and electronics.

Table 6-4
End-Users Estimated Fiscal Impact Comparisons, 1999 and 2005

Selected Local Government Receipts	1999	2005	Percentage Change
Total Local Taxes	$32,334,815	$48,847,006	51%
Property Taxes	28,805,493	40,793,196	42%
Other Taxes	3,529,322	8,053,810	128%
Selected State Receipts			
Total State Taxes	60,428,213	71,038,070	18%
Personal Income Tax	30,265,124	27,845,199	-8%
Sales and Gross Receipts Taxes	20,600,796	32,457,166	58%
Corporation Taxes	4,167,777	2,303,469	-45%
Other Taxes	5,394,516	8,432,236	56%
Combined State and Local Taxes	$92,763,028	$119,885,076	29%

6.5 Findings

This is the third study of this kind in the last decade. The approach to this analysis is unique because it assigns industrial production values to the different commodities that are processed even though many of those commodities are collected, sorted, and processed by some firms that specialize in one material (such as metals) and others that process all types of recyclable materials. The impact analyses focus on the commodity that is processed, not the individual industries.

Economic impact assessments are affected strongly by several factors over time. First, most industries have very predictable supply and demand relationships with very stable prices. In contrast, the recycling industry has relatively fluid supply and demand relationships and highly volatile prices. When we inject these industries into an accounting system using just one year's worth of data, we are not measuring the historical characteristics of the industry; rather, we are measuring what is discerned during a "snapshot" in time. We recommend consideration of on-going annual surveys to compile and develop a normalized set of data to account for strong variations in price, supply, demand, and other factors that influence this industry. The above analysis could then be undertaken to reflect the historical economic impacts of the Iowa recycling industry.

Second, the measurements in this report represent simulations. It must be noted that in all three of these studies, we have created sets of recycling commodity industries and inserted them into the Iowa industrial structure. Those industries all have very similar characteristics, but their input and labor needs are influenced by the volume of the commodity processed and the value of that commodity in the current market. Accordingly, our model allocates labor and labor income in relation to both the quantity of the commodity processed and the value of that commodity. As those values change over time, so too will the allocation of labor and the expected returns to labor for the commodities that are processed. If a commodity appreciates in total weight and in value, then the modeling process puts more labor and labor income in that commodity. As the overall pool of workers and labor income is fixed at any point in time, that results in a reduction in the amount of expected labor to be allocated to other commodities. Changes in the overall estimated economic impacts are therefore a function of both the modeling system and the manner in which labor and labor income are allocated to the commodities.

Overall, it is most appropriate to look at the estimates of total tons processed, the total value of the commodity sales, and the total jobs as the best indicator of this sector's performance over the years. Using those benchmarks, the industry has increased its output strongly, value added has grown, and the total number of jobs associated with the recycling industry has remained relatively stable in Iowa.

In reviewing the comparison results in Table 6-2, the largest overall changes in total industrial output occurred in plastics, aluminum, and wood, as described below:

- Plastics processing suggests a total output impacts increase from $5.5 million to $26.5 million. This is attributed to a 65% increase in tons processed, and large increases in price per ton.
- The total industrial output for aluminum also increased dramatically from $9.8 million to $36.8 million. This can be attributed to increases in tonnage and price per pound from 1999 to 2005.
- The total industrial output for wood declined dramatically from $14.4 million to $6.1 million, most likely due to a 70 percent decrease in price per ton, although tonnage increased 87 percent.

The largest changes relative to jobs occurred in the following sectors: all other paper, plastics, all other metal, and wood. The number of jobs in the all other paper processing sector increased from 367 to 784. The number of total jobs created for plastics processing increased from 59 to 105. The all other metals sector saw the largest decrease in number of jobs, from 1,175 to 565. As for wood, the total jobs created increased from 192 to 334. Overall, the total number of jobs in the recyclable materials processing sector increased slightly from 1999 to 2005.

In reviewing the fiscal impacts comparisons, the recyclable materials processing industry had an estimated 10 percent increase in revenues from 1999 to 2005 and end-use manufacturing increased an estimated 29 percent, based on combined state and local tax revenues.

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Section 7
GREENHOUSE GAS EMISSIONS IMPACT ANALYSIS

This section provides an analysis of the environmental impact, in terms of greenhouse gas (GHG) emission reductions, of recycling in Iowa. The analysis presented in this section considers the recycling and composting activities that contribute to GHG emission reductions throughout the materials use cycle.

7.1 Overview of Greenhouse Gas Emissions

7.1.1 The Relationship between Solid Waste Management Practices and Climate Change

Greenhouse gases can be produced by a number of human activities, including solid waste disposal. In fact, disposed materials represent a long series of steps that have the potential to produce GHG emissions. These steps, which are also referred to as a product's "lifecycle", result in emissions, which are often categorized into two levels:

- Upstream emissions - A number of steps that may produce GHG emissions occur prior to the production of materials that are disposed. These steps may include the extraction of raw materials, the transportation of raw materials to manufacturers and processors, and the manufacture of products. These activities require considerable energy and the burning of fossil fuels which, in turn, generate carbon dioxide.
- Downstream emissions - When products are disposed GHG emissions are produced through combustion or landfilling.

Conversely, materials that are recycled may result in reducing some GHG emissions.

When carbon is stored or sequestered[1] in a sink, such as a forest, it is precluded from entering the atmosphere and contributing to the "greenhouse effect". For example when paper is recycled and fewer trees are harvested to make new paper products, more carbon may be sequestered, which reduces the amount of carbon in the atmosphere.

[1] Carbon sequestration refers to natural or man-made processes that remove carbon from the atmosphere and store it for long-periods or permanently. If carbon is stored, it is not emitted as carbon dioxide into the atmosphere contributing to the "greenhouse effect". Therefore, carbon sequestration reduces GHG concentrations.

Landfills may act as a sink because much of the organic matter disposed in landfills does not decompose and release carbon into the atmosphere. However, the benefit of using landfills as a carbon sink may be negated if the landfill does not have a methane gas collection system to preclude most of the methane from being released into the atmosphere. It should be noted that even in cases where landfills have gas collection systems, they do not capture 100 percent of the methane produced and some methane invariably gets released into the atmosphere.

Greenhouse gas emissions from the life cycle of solid waste include[2]:

- Carbon Dioxide (CO_2) - Most carbon dioxide emissions result from energy production, particularly fossil fuel combustion. Fossil fuels are frequently required for 1) extracting and processing raw materials; 2) manufacturing products; 3) managing products at the end of their useful life; and 4) transporting materials and products between each stage of their life cycles.
- Methane (CH_4) - Methane is produced when organic waste decomposes in an anaerobic (oxygen-free) environment, such as a landfill. Landfills are the largest source of methane gas, created solely by human activities, in the United States.
- Nitrous Oxide (N_2O) - Nitrous oxides can be emitted when solid waste is combusted. N_2O also results from the use of commercial and organic fertilizers.
- Perfluorocarbons (PFLs) - Perfluorocarbons are emitted during the aluminum smelting process when the raw material alumina is reduced to make aluminum.

7.1.2 The Impact of Specific Solid Waste Management Practices on Climate Change

7.1.2.1 Source Reduction

Source reduction, waste prevention and “pre-cycling” are different terms for the same activity—reducing the amount of waste that is generated. When less waste is generated, the emissions associated with generation and managing the materials are avoided. Source reduction can be achieved by practices such as light-weighting (i.e., making beverage containers lighter by using less material), double-sided copying, and material reuse.

7.1.2.2 Recycling

When a material is recycled, it is used in place of virgin inputs in the manufacturing process, rather than being disposed of and managed as waste. Thus, recycling avoids the CO_2 emissions from the combustion of fuels used to operate the equipment associated with locating, extracting and processing raw materials. Additionally, manufacturing a product from recycled inputs often requires less fossil fuels than making a product from virgin inputs. Finally, paper recycling results in additional carbon sequestration in forests.

[2] Source: U.S. EPA, “Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks”, 2006.

Greenhouse gases, such as CO_2 and NO_2, may be released during the recycling process, which includes:

1. Transporting materials from the point of collection to the processing facility;
2. Processing the material;
3. Transporting materials from the recycling facility to a broker; and/or
4. Transporting materials from a broker to the plant that processes the recyclables into new products.

These emissions are usually offset by the avoidance of emissions that would have been released during locating, extracting and processing virgin raw materials.

7.1.2.3 Composting

When organic materials are composted, most of their organic mass decomposes to CO_2. However, carbon emissions that result from composting are not considered as greenhouse gas emissions for two reasons. First, CO_2 emissions produced during the decomposition of compostable materials such as yard trimmings, food residuals and newspapers are considered biogenic emissions, or emissions caused by a natural process rather than human activities. Second, tree and plant materials absorb CO_2 during the growing process. Although composting may result in some production of methane (due to anaerobic decomposition in the center of the pile), compost researchers believe that methane is almost always oxidized to CO_2 before it escapes the compost pile[3]. Research of emissions resulting from the composting process continues to evaluate this issue.

Because the CO_2 emissions from composting generally produce no methane, the only GHG emissions from composting result from the transportation of compostable materials to composting facilities and the mechanical turning of compost piles.

7.1.2.4 Combustion

When solid waste is combusted, two critical GHGs are emitted: CO_2 and N_2O. However, combustion of MSW with energy recovery in a waste-to-energy (WTE) facility results in avoided CO_2 emissions. The avoided emissions are due to direct electricity production and heating or cooling provided from a co-generation, or combined heat and power, type of facility. Either directly or indirectly, WTE displaces electricity that would otherwise be provided by an electric utility power plant. Because most utility power plants burn fossil fuels, and thus emit CO_2, the electricity produced by a WTE plant reduces utility CO_2 emissions.

7.1.2.5 Landfilling

Decomposition of organic wastes, such as yard trimmings, household waste, food residuals and paper, occurs in landfills and produces methane. While methane emissions from landfills are affected by factors such as waste composition, moisture

[3] Ibid.

and landfill size, landfills are the largest single human source of methane emissions in the United States.

Carbon dioxide is produced during the decomposition process of food scraps, yard trimmings and paper. Significant methane production typically begins one or two years after waste disposal in a landfill and continues for 10 to 60 years[4].

7.2 Methodology of GHG Emissions Impact Analysis

The methodology used to estimate the GHG emission reductions in Iowa as a result of recycling efforts, was based on application of the Waste Reduction Model (WARM) developed by the United States Environmental Protection Agency (EPA). This model was developed and refined over many years, with input from a range of groups including industry experts, environmental organizations, government agencies, and academia.

The WARM model is designed to estimate GHG emission reductions from several different waste management practices. The model is based on unique assumptions tailored for 34 different material types. Inputs to the model include the scenarios to be compared (e.g., the amount of each material type and the method used to manage it including recycling, landfilling, composting or combustion), and the average shipping distance of recyclable materials to market.

In this analysis, estimated values for the amount of each type of material recycled and composted in Iowa were entered into the model. For paper, plastics, glass, metals, and wood, the estimated baseline tons collected in Iowa in 2005 from Table 4-1 were used (not including tons exported). For C&D, organics, and electronics, the collected tons reported from survey respondents were used (Table 4-3). The WARM model does not include certain items such as asphalt, shingles, drywall, and mixed C&D, so those tons were not entered into the model. Also, the tires collected in Iowa were not input because the model asks for only retreaded tire tonnage, none of which were reported from the surveys. For tons landfilled, by material type, 2005 tonnage data was used from the Iowa Statewide Waste Characterization Study.

The model's default transport distances of twenty miles were used for the average distance from the curb to the landfill, compost facility, or materials recovery facility (MRF).

Table 7-1 below lists the estimated 2005 Iowa tons entered into the WARM model for the baseline management scenario.

[4] Source: U.S. EPA, "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005", 2007.

Table 7-1
Data Inputs for the WARM Model
2005 Iowa Estimated Tons

Material	Tons Generated[1]	Tons Recycled[2]	Tons Landfilled[3]	Tons Combusted	Tons Composted[2]
Aluminum Cans	28,411	21,979	6,432	NA	NA
Steel Cans	31,418	10,516	20,902	NA	NA
Copper Wire	0	0	0	NA	NA
Glass	99,872	63,428	36,444	NA	NA
HDPE	26,438	5,000	21,438	NA	NA
LDPE	610	610	0	NA	NA
PET	25,139	11,740	13,399	NA	NA
Corrugated Cardboard	330,237	149,625	180,612	NA	NA
Magazines/Third-class Mail	186,775	0	186,775	NA	NA
Newspaper	325,214	240,000	85,214	NA	NA
Office Paper	55,004	2,750	52,254	NA	NA
Phonebooks	0	0	0	NA	NA
Textbooks	0	0	0	NA	NA
Dimensional Lumber	344,525	167,665	176,860	NA	NA
Medium-density Fiberboard	0	0	0	NA	NA
Food Scraps	225,595	0	225,095	NA	500
Yard Trimmings	101,573	0	34,300	NA	67,273
Grass	0	0	0	NA	0
Leaves	0	0	0	NA	0
Branches	0	0	0	NA	0
Mixed Paper (general)	349,636	153,214	196,422	NA	NA
Mixed Paper (primarily residential)	0	0	0	NA	NA
Mixed Paper (primarily from offices)	0	0	0	NA	NA
Mixed Metals[4]	250,620	178,000	72,620	NA	NA
Mixed Plastics[5]	298,059	16,959	281,100	NA	NA
Mixed Recyclables[6]	0	0	0	NA	NA
Mixed Organics[7]	44,301	0	31,620	NA	12,681
Mixed MSW[8]	1,007,566	0	1,007,566	NA	NA
Carpet	575	575	0	NA	NA
Personal Computers	51,281	634	50,647	NA	NA

Table 7-1
Data Inputs for the WARM Model
2005 Iowa Estimated Tons

Material	Tons Generated[1]	Tons Recycled[2]	Tons Landfilled[3]	Tons Combusted	Tons Composted[2]
Clay Bricks	0	0	0	NA	NA
Concrete[9]	5,382	5,382	0	NA	NA
Fly Ash[10]	0	0	0	NA	NA
Tires[11]	0	0	0	NA	NA
Totals:	3,788,231	1,028,077	2,679,700	0	80,454

[1] Tons Generated equals tons recycled + tons landfilled + tons combusted + tons composted.
[2] Source: Tables 4-1 and 4-3 of this report.
[3] Source: Iowa Statewide Solid Waste Composition, 2005 solid waste tons (Table 5-5), Iowa Statewide Waste Characterization Study, February 2006.
[4] Mixed Metals is defined as: Steel 71%, Aluminum 29%.
[5] Mixed Plastics is defined as: HDPE 46%, LDPE 15%, PET 40%.
[6] Mixed Recyclables is defined as: Aluminum Cans 1.4%, Steel 3.4%, Glass 5.2%, HDPE 1.0%, LDPE 0.3%, PET 0.9%, Corrugated Cardboard 46.8%, Magazines/Third-class Mail 5.5%, Newspaper 23%, Office Paper 8.8%, Phonebooks 0.2%, Textbooks 0.4%, Dimensional Lumber 2.8%.
[7] Mixed Organics is defined as: Food Scraps 48%, Yard Trimmings 52%.
[8] Mixed MSW represents the entire municipal solid waste stream as disposed.
[9] Recycled concrete used as aggregate in the production of new concrete.
[10] Recycled fly ash is utilized to displace Portland cement in concrete production.
[11] Recycling tires is defined in this analysis as retreading and does not include other recycling activities (i.e. crumb rubber applications).

The following section presents the model results.

7.3 Greenhouse Gas Emissions Impacts

Table 7-2 shows the greenhouse gas emissions of each waste management practice,[5] based on the WARM model results for the state of Iowa. The annual GHG emissions are reported as Metric Tons of Carbon Equivalent (MTCE). A negative value (i.e., a value in parentheses) indicates an emission reduction; a positive value indicates an emission increase.

Environmental impacts beyond greenhouse gas emissions were not evaluated. It also should be noted that this analysis does not constitute a full-fledged environmental life-cycle analysis study, but rather only an inventory of impacts based on WARM model results.

[5] The model results are based on tons recycled, landfilled, combusted, and composted. Source Reduction was not included in the analysis.

Table 7-2
Iowa Greenhouse Gas Emissions[1] From Baseline Management of Municipal Solid Wastes

Material	Baseline Generation of Material (Tons)	Estimated Recycling (Tons)	Annual GHG Emissions from Recycling (MTCE)	Estimated Landfilling (Tons)	Annual GHG Emissions from Landfilling (MTCE)	Estimated Combustion (Tons)	Annual GHG Emissions from Combustion (MTCE)	Estimated Composting (Tons)	Annual GHG Emissions from Composting (MTCE)	Total Annual GHG Emissions (MTCE)
Aluminum Cans	28,411	21,979	(81,341)	6,432	67	0	0	NA	NA	(81,274)
Steel Cans	31,418	10,516	(5,145)	20,902	217	0	0	NA	NA	(4,929)
Copper Wire	0	0	0	0	0	0	0	NA	NA	0
Glass	99,872	63,428	(4,807)	36,444	378	0	0	NA	NA	(4,429)
HDPE	26,438	5,000	(1,898)	21,438	222	0	0	NA	NA	(1,676)
LDPE	610	610	(282)	0	0	0	0	NA	NA	(282)
PET	25,139	11,740	(4,924)	13,399	139	0	0	NA	NA	(4,785)
Corrugated Cardboard	330,237	149,625	(126,961)	180,612	19,718	0	0	NA	NA	(107,243)
Magazines/third-class mail	186,775	0	0	186,775	(15,337)	0	0	NA	NA	(15,337)
Newspaper	325,214	240,000	(182,719)	85,214	(20,176)	0	0	NA	NA	(202,895)
Office Paper	55,004	2,750	(2,139)	52,254	27,683	0	0	NA	NA	25,544
Phonebooks	0	0	0	0	0	0	0	NA	NA	0
Textbooks	0	0	0	0	0	0	0	NA	NA	0
Dimensional Lumber	344,525	167,665	(112,302)	176,860	(23,523)	0	0	NA	NA	(135,825)
Medium Density Fiberboard	0	0	0	0	0	0	0	NA	NA	0
Food Scraps	225,595	NA	NA	225,095	44,428	0	0	500	(27)	44,401
Yard Trimmings	101,573	NA	NA	34,300	(2,049)	0	0	67,273	(3,643)	(5,692)
Grass	0	NA	NA	0	0	0	0	0	0	0
Leaves	0	NA	NA	0	0	0	0	0	0	0

Table 7-2
Iowa Greenhouse Gas Emissions[1] From Baseline Management of Municipal Solid Wastes

Material	Baseline Generation of Material (Tons)	Estimated Recycling (Tons)	Annual GHG Emissions from Recycling (MTCE)	Estimated Landfilling (Tons)	Annual GHG Emissions from Landfilling (MTCE)	Estimated Combustion (Tons)	Annual GHG Emissions from Combustion (MTCE)	Estimated Composting (Tons)	Annual GHG Emissions from Composting (MTCE)	Total Annual GHG Emissions (MTCE)
Branches	0	NA	NA	0	0	0	0	0	0	0
Mixed Paper, Broad	349,636	153,214	(147,793)	196,422	18,653	0	0	NA	NA	(129,140)
Mixed Paper, Resid.	0	0	0	0	0	0	0	NA	NA	0
Mixed Paper, Office	0	0	0	0	0	0	0	NA	NA	0
Mixed Metals	250,620	178,000	(255,225)	72,620	753	0	0	NA	NA	(254,472)
Mixed Plastics	298,059	16,959	(6,911)	281,100	2,914	0	0	NA	NA	(3,997)
Mixed Recyclables	0	0	0	0	0	0	0	NA	NA	0
Mixed Organics	44,301	0	NA	31,620	2,037	0	0	12,681	(687)	1,351
Mixed MSW	1,007,566	0	NA	1,007,566	116,498	0	0	NA	NA	116,498
Carpet	575	575	(1,126)	0	0	0	0	NA	NA	(1,126)
Personal Computers	51,281	634	(391)	50,647	525	0	0	NA	NA	134
Clay Bricks	0	0	NA	0	0	NA	NA	NA	NA	0
Concrete	5,382	5,382	(11)	0	0	NA	NA	NA	NA	(11)
Fly Ash	0	0	0	0	0	NA	NA	NA	NA	0
Tires	0	0	0	0	0	0	0	NA	NA	0
Total	3,788,231	1,028,077	(933,975)	2,679,700	173,146	0	0	80,454	(4,357)	(765,185)

[1] The annual GHG emissions are reported as Metric Tons of Carbon Equivalent (MTCE). A negative value (i.e., a value in parentheses) indicates an emission reduction; a positive value indicates an emission increase.

7.4 Summary

Based on the WARM model results presented in Table 7-2, by recycling and composting in 2005, GHG emissions were reduced in Iowa by a net total of 765,185 MTCE.

The material types that provided the most net benefit in terms of reducing GHG emissions include:

1. Mixed Metals – 254,472 MTCE;
2. Newspaper – 202,895 MTCE;
3. Dimensional Lumber – 135,825 MTCE;
4. Mixed Paper – 129,140 MTCE; and
5. Corrugated Cardboard – 107,243 MTCE.

The per ton estimates of GHG emissions for various solid waste management methods, per the WARM model, are included in Table C-1 of Appendix C. The table shows that the materials which provide the greatest benefit when recycled (in MTCEs per ton) include aluminum cans, copper wire, mixed metals, and carpet.

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8.1 Project Objective and Purpose

In 1997, the IDNR's objective of the Economic Impacts of Recycling in Iowa study was to:

- Measure the current economic impacts of recycling activities (collectors, processors, brokers, end-users, and recycling equipment manufacturers) on Iowa employment, income, and tax revenue; and
- Identify specific recyclable material market development opportunities that maximize beneficial impacts upon Iowa's economy.

R. W. Beck conducted the 1997 study, as well as a follow-up study in 2000, to again assess the economic impacts of recycling on Iowa's economy. Because the recycling industry in Iowa is continually changing, the IDNR chose to again update the study in 2006 to better position itself to assist businesses by:

- Finding additional markets for recyclable materials;
- Fine-tuning its technical assistance;
- Assisting with short- and long-term planning efforts;
- Advocating funding for program support and policy implementation; and
- Promoting the major role Iowa's recycling industry plays in the Iowa economy.

The results of this Study will allow the IDNR to improve current statewide programs of the Department of Natural Resources like Pollution Prevention Services, Iowa Waste Exchange (IWE) and the Solid Waste Alternatives Program (SWAP). These three programs in 2005 saved Iowa businesses over $5 million dollars and invested $3 million dollars in Iowa's recycling industry.

In addition to updating the study and comparing the results to the 2001 Study, this update included two additional tasks:

1. Analyze the impacts of the remanufacturing and reuse industries on Iowa's economy; and
2. Analyze the environmental impacts, in terms of GHG emission reductions, of recycling in Iowa.

8.2 Recommendations

8.2.1 Overview

The following criteria were used in developing these recommendations:

- Projected economic impacts by commodity type;
- Supply/demand recyclable materials balance comparing materials processed and consumed;
- Calculated change in the quantities of materials recycled when comparing the 2001 Study results to the current Study results; and
- Industry knowledge and experience.

The recommendations have been organized into four groups as identified below:

- Facilitation and Analysis;
- Financial Incentives;
- Regulation; and
- Targeted Programs.

8.2.2 Facilitation and Analysis

Because of the IDNR's well-established role and involvement with recycling in Iowa, its access to key recycling industry players and relevant information/analysis can be leveraged to promote recycling market development. Provided below are recommended initiatives.

- Meet with key end-users of OCC to discuss the economic benefits of increasing the use of Iowa OCC in their manufacturing processes. Per the survey results (Section 3 of this report), eighty-five percent of the OCC consumed by end-users in 2005 was imported from outside Iowa. Following discussions with end-users, evaluate the potential benefits and drawbacks of establishing regional recyclable materials market development consortiums to enhance the collection and marketing of Iowa OCC within the State.
- Conduct additional research to determine the specific quality of ONP being generated by Iowa processors to identify the compatible end-uses (i.e., newspaper, boxboard, animal bedding, etc.). Per the survey results of those who responded, 61,350 tons of ONP was processed, however only 14,400 tons were reported consumed by end-users in 2005. Based on the results of this analysis, continue to research end-users of ONP, especially those who are importing ONP from out of the state.
- Monitor and facilitate additional growth in the recycling equipment manufacturing industry because of the unique niche composed by this sub-industry of recycling. The number of direct jobs associated with the recycling

equipment manufacturing industry in 2005 was estimated to be 523, up from 360 in 2001.

- Continue to gather recycling data as related to the processing and end-use of C&D debris. More tons were reported processed than reported consumed in 2005. Gather more information on end-users in the state in an attempt to match them with processors of C&D debris.
- Develop an informational campaign targeted toward Iowa's construction industry to promote the recycling of C&D materials at large job sites. Potential diversion opportunities for certain C&D material are listed below:
  - Drywall/Gypsum. Recovery and recycling opportunities for drywall are beginning to emerge, as some states are considering banning gypsum drywall from landfills. The reason for the bans is not only because of the development of hydrogen sulfide gas when gypsum is mixed with moisture, but also due to the strong sulfur odor emitted by decaying gypsum.

    Drywall is often ground up and used as a soil fertilizer because the gypsum from drywall is a source of calcium and sulfur similar to agricultural gypsum. Many communities promote donating clean sheets of drywall to building projects such as Habitat for Humanity. Until recycling markets emerge in the region for drywall, it is recommended that the state promote the separation and donation of clean drywall to non-profit construction and renovation projects. Provided below are references to websites regarding gypsum drywall recycling.

    - WasteCap Wisconsin, "Drywall Reuse and Recycling Documents": http://www.wastecapwi.org/drywall.htm
    - California Integrated Waste Management Board, "Wallboard (Drywall) Recycling": http://www.ciwmb.ca.gov/ConDemo/Wallboard/#Processors
  - Non-treated wood. Non-treated wood is typically one of the largest material categories in the C&D waste stream. This subcategory of wood is primarily associated with pallets and crates. The largest barrier associated with the recovery of this material is generally the extent of contamination. Most pallet companies take back old pallets and use the wood in the remanufacturing of new pallets or process the broken pieces into wood chips for mulch or for use in wood burning stoves. Many municipalities accept wooden pallets for grinding or chipping as part of their wood waste and composting program.

    The state may also consider researching and promoting to the business community the use of reusable plastic pallets for shipping. Reusable shipping containers, including plastic pallets, can help businesses reduce their long-term costs while preventing unnecessary waste by reducing packaging costs, reducing damage to goods, reducing labor costs of handling pallet waste, and avoiding disposal costs.

A list of references for reusable shipping container information is provided below.

- State of Oregon Department of Environmental Quality, "Packaging Waste Reduction Best Practices, Plastic Pallets": http://www.deq.state.or.us/lq/pubs/docs/sw/packaging/bpplasticpallets.pdf
- Minnesota Pollution Control Agency, "Reusable Transport Packaging Directory": http://www.pca.state.mn.us/oea/transport/

- Asphalt shingles. The largest barrier associated with the recovery of shingles is generally lack of markets. In certain states, markets exist for asphalt shingles including hot mix asphalt, aggregate road base, dust control on rural roads, and fuel. References to shingle recycling are provided below.
  - Shingle Recycling website: http://www.shinglerecycling.org/
  - Minnesota Pollution Control Agency, "Roofing Shingles into Roads": http://www.moea.state.mn.us/lc/purchasing/shingles.cfm
  - National Association of Home Builders (NAHB) Research Center, "From Roofs to Roads": http://www.epa.gov/epaoswer/non-hw/debris-new/pubs/roof_br.pdf#search=%22shingle%20recycling%22

- Continue to gather recycling data as related to the processing and end-use of organics, especially food residuals. This is an area of waste diversion that is growing nationwide and in fiscal year 2006, SWAP identified organics as a specific material in the waste stream to be targeted for increased diversion opportunities. Per the survey respondents, 11,000 tons of food residuals were processed in 2005, however no end-users were identified. It is likely most of the food is being composted with yard trimmings. Upon gathering additional organics processing and end-use data, revisit the economic impacts of this diversion activity.

- Monitor the growth in the end-of-life electronics recycling industry, as this continues to be a growing part of the waste stream. Consider development of a business prospectus that highlights the opportunities for electronics processing and end-use in the state.

- Recycled plastic continues to be an underutilized commodity based on the materials commodity flow analyses. In 2005, more tons of plastic (specifically PET and mixed plastics) were processed than consumed by end-users in Iowa. Because average prices paid by end-users have increased dramatically since the 2001 Study, overall economic impacts are greater. The plastics processing industry had the highest jobs multiplier in this Study at 2.53, compared to the fourth highest at 1.73 in the 2001 Study. We recommend enhancing additional processing and end-use opportunities for plastics in Iowa.

- Include the recycling survey as part of the comprehensive solid waste management planning requirements. It would be in each planning area's best interest to encourage their municipalities and businesses associated with recycling to respond to the survey. If the survey is periodically required, respondents may be more likely to complete it.

8.2.3 Financial Incentives

As discussed in Section 6, this Study used an updated modeling system in which the multiplier is referred to as a social account matrix or SAM multiplier rather than the previous Type I and Type II multipliers. The SAM multiplier is preferred within the economic modeling industry because it includes the contributions of households as industries and exchangers of production goods and services when calculating economic impacts.

In order to determine which commodities, when recycled, create the most jobs, the multipliers can be compared. Table 8-1 below lists the jobs multipliers for each commodity, in descending order.

Table 8-1
Total Jobs Multipliers
(2007 Study)

Commodity	Jobs Multiplier
Plastics	2.53
All Other Metal	2.48
Aluminum	2.39
Old Corrugated Containers	1.74
Glass	1.69
Wood	1.65
All Other Paper	1.64

Table 8-1 shows that for every 100 jobs directly created in the plastics recycling industry, 153 additional jobs are created through supporting economic activity. This is followed by metal (other than aluminum), aluminum, and OCC.

The collection and processing infrastructure for aluminum beverage containers is well established in Iowa as a result of the Iowa "bottle bill". Thus, even though the jobs multipliers for aluminum are third highest of the commodities, we would not recommend resources be put towards enhancing the processing of aluminum scrap.

The materials flow analysis identified excess supply of most recycled plastics. As shown in Table 8-1, plastics represents the largest jobs multiplier. Therefore, we recommend that resources be put forth to promote increased end-use of various plastics, especially PET and mixed plastics.

The following represents additional financial program incentives that should be considered by the IDNR to address commodity flow to balance supply and demand:

- Offer an OCC processing subsidy to Iowa processors to promote an increase in the supply of OCC. This subsidy would be offered directly to processors for marketing Iowa-generated OCC to Iowa end-users.
- Enhance the end-use of wood waste by providing additional targeted grants to other potential end-users of wood waste.
- Develop and distribute a business prospectus for attracting a large user of ONP to the state of Iowa upon identifying the end-use most compatible with the ONP supply.

8.2.4 Regulation

The use of various regulatory approaches can be used to stimulate the market. Some approaches for consideration include:

- State-wide landfill disposal ban of OCC to generate an increased supply of OCC.
- State-wide landfill disposal ban of selected wood waste items, such as pallets.
- Expand the beverage container deposit law to include non-carbonated beverages, to capture the increasing number of PET and HDPE single-serve, plastic containers from water, juice and sports drinks.

8.2.5 Targeted Programs

The IDNR has several state programs that are designed to reduce waste and promote recycling in Iowa including:

- Solid Waste Alternatives Program;
- Pollution Prevention Services; and
- Iowa Waste Exchange.

The economic impacts of the state's targeted programs in 2005 were calculated using the estimated tons of recyclable material reported by the IDNR that were sent for processing[1] as a result of these programs. These tons were calculated as a fraction of the "All Suppliers" tons in Table 4-2 of this report. The fractions were then multiplied by the "Expected 2005 Gross Receipts" also found in Table 4-2. The economic multipliers used in Tables 8-2 and 8-3 of this section were derived from Table 4-4, "Estimated Economic Impacts of Iowa's Recycled Commodity Processing Industries".

[1] Per the IDNR, the tons provided do not include program numbers on any internal or external material reclaim/reuse projects, waste reduction projects, end-market development projects, or beneficial use activities such as alternative daily cover for landfills. They are limited to the types of diverted materials included for analysis in this economic study. These numbers do include materials reportedly diverted in 2005 from funded projects.

8.2.5.1 Solid Waste Alternatives Program

SWAP works to reduce the amount of solid waste generated and the amount and toxicity of solid waste landfilled in Iowa. Through a competitive process, financial assistance is available for a variety of projects including source reduction, recycling, market development and education.

Recipients of SWAP funding include local government programs, Iowa business and industry projects, market development efforts and educational initiatives aimed to divert waste from being landfilled in Iowa.

The program provides financial assistance in the form of forgivable loans, zero interest loans, and three-percent interest loans. A fifty percent cost share is required through cash and in-kind matches. Projects are selected through a quarterly competitive process.

In 2005, a total of thirty-eight (38) SWAP projects were funded. Nearly $2.4 million dollars were awarded to diversion projects and contractors' matching funds exceeded $4.1 million, bringing SWAP's total financial investment to reduce the quantities of solid waste being generated and landfilled to over $6.5 million, per the IDNR.

Table 8-2 shows the estimated economic impacts of SWAP in 2005, as a percentage of the statewide tons and total receipts.

Table 8-2
Estimated Economic Impacts of the Solid Waste Alternatives Program[1]
(2007 Study)[2]

Old Corrugated Containers	Direct	Indirect	Induced	Total[3]	Multiplier
Industrial Output($)	4,569,132	659,417	416,632	5,645,182	1.24
Value Added($)	3,133,266	859,236	655,058	4,647,560	1.48
Labor Income($)	1,717,089	737,437	554,851	3,009,378	1.75
Jobs	73	32	22	127	1.74
All Other Paper	**Direct**	**Indirect**	**Induced**	**Total[3]**	**Multiplier**
Industrial Output($)	4,003,294	481,463	332,127	4,816,884	1.2
Value Added($)	2,906,310	684,104	568,810	4,159,223	1.43
Labor Income($)	1,663,003	595,174	488,928	2,747,105	1.65
Jobs	74	27	21	122	1.64
Plastics	**Direct**	**Indirect**	**Induced**	**Total[3]**	**Multiplier**
Industrial Output($)	2,870,028	621,303	750,288	4,241,620	1.48
Value Added($)	815,210	189,574	283,167	1,287,950	1.58
Labor Income($)	151,558	97,634	140,406	389,599	2.57
Jobs	7	4	6	17	2.53
Glass	**Direct**	**Indirect**	**Induced**	**Total[3]**	**Multiplier**
Industrial Output($)	138,847	47,555	33,704	220,107	1.59
Value Added($)	84,635	49,738	18,237	152,610	1.8
Labor Income($)	92,679	46,437	17,374	156,490	1.69
Jobs	5	2	1	8	1.69
Aluminum	**Direct**	**Indirect**	**Induced**	**Total[3]**	**Multiplier**
Industrial Output($)	422,032	112,679	73,653	608,365	1.44
Value Added($)	110,787	27,272	22,264	160,323	1.45
Labor Income($)	13,339	10,598	8,250	32,188	2.41
Jobs	0	0	0	1	2.39
All Other Metal	**Direct**	**Indirect**	**Induced**	**Total[3]**	**Multiplier**
Industrial Output($)	1,292,258	372,997	235,549	1,900,804	1.47
Value Added($)	395,961	138,250	107,279	641,490	1.62
Labor Income($)	96,695	83,055	62,460	242,209	2.5
Jobs	3	3	2	8	2.48
All Commodities[4]	**Direct**	**Indirect**	**Induced**	**Total[3]**	**Multiplier**
Industrial Output($)	13,295,593	2,295,415	1,841,954	17,432,961	1.41
Value Added($)	7,446,168	1,948,173	1,654,814	11,049,156	1.53
Labor Income($)	3,734,364	1,570,336	1,272,270	6,576,969	1.92
Jobs	162	69	52	283	1.86

[1] Based on materials processing activities only.

[2] All data is for calendar year 2005. Source of data: Iowa Department of Natural Resources.

[3] Totals may not sum due to rounding.

[4] Wood Scrap was not included in this analysis because the tonnage estimated by the IDNR as diverted through SWAP in 2005 was disproportionate to the other commodities and therefore was considered an outlier.

The economic impacts from these materials processed through SWAP are a subset of the statewide results shown in Table 4-4 of this report. As discussed in Section 4, the direct industrial output corresponds with the expected receipts for that industry that were displayed in Table 4-2. The highest category for industrial output was "Old Corrugated Containers" at $4.5 million in receipts. The indirect values represent industrial inputs into production to produce the direct commodity that we are measuring. Induced activity comes about as a result of workers receiving salaries and wages and converting them into household spending. The sum of all direct, indirect, and induced values in a category yields the total economic value.

The economic multiplier is simply a ratio of the total economic value in a category to the direct value, or the expected change in the total economy per unit change in the direct value. The multipliers identified in Table 4-4 were used in Table 8-2. For example, the labor income multiplier for OCC of 1.75 means that for every dollar in labor income in the direct sector, $0.75 in additional income is sustained in the rest of the economy. The total labor income from processing OCC through SWAP was estimated to provide over $3 million in 2005.

The economic assumptions are the same as developed through the survey process; sales, number of employees, and employee compensation were used to assess the economic impacts of commodity production.

Each year since fiscal year 2003, SWAP has identified specific waste streams to be targeted and seeks out applications for projects that focus on addressing those wastestreams. In fiscal year 2006, SWAP's targeted wastestreams included:

- Electronics waste;
- Organics; and
- Construction and demolition waste.

These are three wastestreams in which diversion opportunities continue to emerge nationwide as communities move toward restricting or banning these materials from being landfilled. Per our survey results, more data is required from collectors and processors of these three material categories to determine the full impact on Iowa's economy.

8.2.5.2 Pollution Prevention Services

Pollution Prevention (P2) Services, and its predecessor, the Waste Reduction Assistance Program (WRAP), were established to help Iowa organizations and companies adopt sustainable business practices. The assistance is offered at no-cost, and is confidential and non-regulatory.

Organizations working with Pollution Prevention Services have access to an assortment of waste reduction assistance, technology transfer opportunities, case studies, vendor lists, technical conferences and workshops, and waste exchange services.

Clients include business and industry, institutions, government agencies with more than 100 employees, Resource Conservation & Recovery Act (RCRA) Large Quantity Generators, and Toxics Release Inventory (TRI) reporting facilities.

The assistance provided by Pollution Prevention Services include:

- Initial consultation;
- Plant-wide or focused assessments;
- Project and program evaluation;

- Pollution prevention program;
- Environmental Management Systems development assistance;
- Source reduction alternatives;
- Educational workshops and training; and
- Pollution Prevention Intern Program.

The Pollution Prevention Intern Program plays a large role in conducting P2 assessments while providing upper-level undergraduate and graduate students from Iowa with hands-on experience in reducing pollution, waste, and toxicity for Iowa companies and public organizations using P2 strategies. The cost savings are typically determined by the reduction of waste being generated (including solid waste, special waste, and hazardous waste), the gallons of water conserved, and the amount of energy reduced. Besides cost savings, other reductions are calculated such as air emissions avoided and green house gas emissions reduced or diverted.

In 2005, the P2 Intern Program assisted approximately 27 businesses, resulting in overall cost savings of over $4.1 million, averaging more than $150,000 in cost savings per company.

When calculated as a percentage of the total tons and total receipts in 2005, the estimated economic impacts of P2 Services was very small. The estimate only included quantities recycled, and did not reflect the program's impacts realized through the energy, water, and air emissions savings generated. The total number of jobs for all commodities combined was calculated to be less than two; therefore R. W. Beck did not include a detailed characterization of the results. Obviously this does not imply the program is not beneficial; the preceding paragraph outlines the positive impacts of P2 Services.

8.2.5.3 Iowa Waste Exchange

The IWE is a no-cost, non-regulatory, confidential service that matches institutions that produce by-products and waste with other groups interested in using or recycling those materials. The program helps businesses, schools, hospitals and communities save disposal money and protect the environment by reducing, reusing and recycling materials.

In 2005, the IWE program assisted 2,212 businesses and diverted nearly 71,000 tons from being landfilled by matching businesses with items available with businesses needing particular items or materials. The cost savings attributed to diversion through the IWE program was estimated by the IDNR at over $2.2 million.

The estimated economic impacts of the IWE in 2005, as a percentage of the total tons and total receipts, are shown below in Table 8-3.

Table 8-3
Estimated Economic Impacts of the Iowa Waste Exchange Program[1]
(2007 Study)[2]

Old Corrugated Containers	Direct	Indirect	Induced	Total[3]	Multiplier
Industrial Output($)	185,720	26,803	16,935	229,458	1.24
Value Added($)	127,357	34,925	26,626	188,908	1.48
Labor Income($)	69,794	29,974	22,553	122,321	1.75
Jobs	3	1	1	5	1.74
All Other Paper	**Direct**	**Indirect**	**Induced**	**Total[3]**	**Multiplier**
Industrial Output($)	268,014	32,233	22,235	322,482	1.2
Value Added($)	194,573	45,799.59	38,081	278,453	1.43
Labor Income($)	111,335	39,845.91	32,733	183,914	1.65
Jobs	5	2	1	8	1.64
Plastics	**Direct**	**Indirect**	**Induced**	**Total[3]**	**Multiplier**
Industrial Output($)	862,440	186,701	225,461	1,274,602	1.48
Value Added($)	244,970	56,967	85,091	387,028	1.58
Labor Income($)	45,543	29,339	42,192	117,074	2.57
Jobs	2	1	2	5	2.53
Glass	**Direct**	**Indirect**	**Induced**	**Total[3]**	**Multiplier**
Industrial Output($)	4,963	1,700	1,205	7,867	1.59
Value Added($)	3,025	1,778	652	5,454	1.8
Labor Income($)	3,312	1,660	621	5,593	1.69
Jobs	0	0	0	0	1.69
Aluminum	**Direct**	**Indirect**	**Induced**	**Total[3]**	**Multiplier**
Industrial Output($)	17,922	4,785	3,128	25,835	1.44
Value Added($)	4,705	1,158	945	6,808	1.45
Labor Income($)	566	450	350	1,367	2.41
Jobs	0	0	0	0	2.39
All Other Metal	**Direct**	**Indirect**	**Induced**	**Total[3]**	**Multiplier**
Industrial Output($)	7,640,842	2,205,452	1,392,750	11,239,043	1.47
Value Added($)	2,341,229	817,444	634,315	3,792,988	1.62
Labor Income($)	571,735	491,085	369,311	1,432,131	2.5
Jobs	19	16	11	46	2.48
Wood Scrap	**Direct**	**Indirect**	**Induced**	**Total[3]**	**Multiplier**
Industrial Output($)	284,517	41,061	18,156	343,734	1.21
Value Added($)	344,112	116,501	61,719	522,332	1.52
Labor Income($)	253,607	108,917	57,352	419,876	1.66
Jobs	11	5	2	19	1.65
All Commodities	**Direct**	**Indirect**	**Induced**	**Total[3]**	**Multiplier**
Industrial Output($)	9,264,416	2,498,735	1,679,869	13,443,021	1.41
Value Added($)	3,259,969	1,074,572	847,430	5,181,971	1.53
Labor Income($)	1,055,894	701,271	525,112	2,282,276	1.92
Jobs	40	26	18	84	1.86

[1] Based on materials processing activities only.

[2] All data is for calendar year 2005. Source of data: Iowa Department of Natural Resources.

[3] Totals may not sum due to rounding.

The highest category for industrial output was “All Other Metal” at $7.6 million in receipts. The labor income multiplier for “All Other Metal” of 2.5 means that for every dollar in labor income in the direct sector, $1.50 in additional income is sustained in the rest of the economy. The total estimated labor income from processing metals (other than aluminum) through IWE resulted in $1.4 million in 2005.

Determining the economic impacts of diverting C&D, organics, electronics and tires through the SWAP and IWE programs was problematic. As was mentioned in Section 4.6.2, the survey results did not provide a definitive characterization of the overall size of these activities in Iowa, especially on the processing side where the economic impacts are compiled. Because the methodologies used for these materials differed than for the other commodities, we did not estimate economic impacts for these materials.

Each of the IDNR’s targeted programs positively impact Iowa’s recycling industry. Because of their different objectives, the programs cannot be easily compared in terms of their level of success. R. W. Beck’s analysis was based solely on tons processed. The SWAP program had the largest impact on landfill diversion.

The P2 program and the IWE both result in cost savings while SWAP projects tend to finance diversion and recycling infrastructure, which will result in cost savings in the future.

Of the three programs described above, SWAP made the largest monetary contribution to source reduction, recycling, and education programs in 2005, while the IWE provided support to the greatest number of entities, by assisting over 2,000 businesses. In general, it is more difficult to measure quantities of waste reduced compared to quantities of waste recycled.

It is our recommendation that the State continue to support these three important programs, as each program has proven to be successful in helping reduce the amount of waste generated in Iowa, as well as increase the quantities of materials recycled.