



# Minnesota's Value-Added Recycling Manufacturing Industries:

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*An Economic and*

*Environmental*

*Profile*





# Minnesota's Value-Added Recycling Manufacturing Industries: An Economic and Environmental Profile

June 1997

Reprinted February 1998



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## **Acknowledgments**

The OEA would like to acknowledge the contributions of the following agencies and individuals who participated by reviewing drafts of the materials and methodologies:

George Treyz, REMI, Inc.

Lisa Petraglia, REMI, Inc.

Nathan Tiller, Minnesota Department of Trade and Economic Development

Ernie Venegas, Minnesota Department of Trade and Economic Development

Narciso Mindajao, Minnesota Department of Revenue

Bob McCarron, Minnesota Pollution Control Agency

Cristine Leavitt, Minnesota Pollution Control Agency

Mike Alexander, Minnesota Department of Public Service

David Benke, Minnesota Office of Environmental Assistance

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A special thanks is extended to the Minnesota companies that participated in the survey. They contributed immensely toward an understanding of the value of their industry to the state's economy.

*Cover printed on 100% post-consumer recycled, unbleached paper.*

*Inside pages printed on 20% postconsumer paper, process chlorine free (PCF).*

# Table of Contents

<b>Chapter 1. Introduction.....</b>	<b>1</b>
Study Methodology .....	1
Summary of Results.....	2
<b>Chapter 2. Economic Profile.....</b>	<b>3</b>
Recycled Material Supplies .....	5
Recycled Feedstock Demand .....	5
Products Manufactured.....	9
<i>Sensitivity to Changes in Feedstock Prices and Availability.....</i>	<i>9</i>
Contribution to State Economy .....	10
<i>Background: The Manufacturing Sector in Minnesota.....</i>	<i>10</i>
<i>Employment by Manufacturers that use Recycled Feedstock.....</i>	<i>12</i>
<i>Revenue Generated.....</i>	<i>15</i>
<i>Private Investment.....</i>	<i>16</i>
<i>Influence on Statewide Economic Indicators.....</i>	<i>16</i>
<i>Assistance from Public Agencies.....</i>	<i>19</i>
<b>Chapter 3. Environmental Benefits.....</b>	<b>20</b>
Avoided Materials Consumption .....	21
Avoided Energy Consumption.....	21
Avoided Emissions of Air and Water Pollutants.....	22
Avoided Landfilling and Use of Land for Extraction and Production .....	23
<b>Chapter 4: Business Opportunities And Barriers .....</b>	<b>23</b>
Public Support.....	24
Infrastructure Characteristics.....	25
Challenges to Business Development and Operation .....	25
<b>Chapter 5. Conclusions.....</b>	<b>25</b>

# List of Tables

Table 1.	Materials Collected for Recycling, 1991-1995 (in tons).....	6
Table 2.	Reported Annual Feedstock Usage.....	7
Table 3.	Reported Additional Unused Capacity.....	8
Table 4.	Product Types Reported.....	11
Table 5.	Estimated Direct Employment, by SIC Code .....	14
Table 6.	Estimates of 1996 Economic Activity Associated with Minnesota's Value-Added Recycling Manufacturers .....	17
Table 7.	Potential Impact of Closure of Companies who Indicate a High Level of Dependence on Recycled Feedstock .....	18
Table 8.	Survey Reported Assistance form 1991-1996.....	19
Table 9.	Assistance Companies Received .....	20

# List of Figures

Figure 1.	Location of Value-Added Manufacturing Businesses by District.....	3
Figure 2.	Location of Value-Added Manufacturing Businesses by District (condensed).....	4
Figure 3.	Effect of Switch to Virgin Materials .....	12
Figure 4.	Loss of Recycled Feedstock on Business Operations .....	12
Figure 5.	Total Estimated Employment by SIC Code.....	13
Figure 6.	Estimated 1996 Sales by SIC Code .....	15

# Minnesota's Value-Added Recycling Manufacturing Industries: An Economic and Environmental Profile

## Chapter 1. Introduction

Minnesota is nationally known for its successful recycling. Most often, the attention focuses on the state's recycling rate, as well as the widespread availability of collection services. Information documenting the amount and type of materials collected and levels of program activity is readily available.

Specific information on the activities and contributions of Minnesota businesses using recycled materials to manufacture finished products is less available. The purpose of this study is to begin to fill that information gap. Companies that use recycled materials provide diverse economic benefits. For instance, they create jobs, invest capital, and contribute tax dollars, thereby increasing the value of the state's economy. They can reduce environmental impacts as well. Manufacturers who use recycled feedstock avoid virgin materials consumption, often saving energy and decreasing air and water pollution. Furthermore, these manufacturers also help conserve landfill space.

This profile describes the economic contributions and general environmental benefits of recycling manufacturing companies. It also provides detailed profiles of several companies to illustrate the types of products and challenges manufacturers may face.

## Study Methodology

The primary tools the Office of Environmental Assistance (OEA) used to develop this study were a survey of manufacturing companies, economic modeling and a review of related studies and reports.

Working with the Minnesota Department of Administration, the OEA conducted a survey in late 1996 of 90 companies. Most companies use recycled materials as feedstocks in manufacturing processes; some produce refined recycled feedstocks for other manufacturers. The OEA included all Minnesota businesses that it could validate as recycled materials users at the time the survey was administered. The survey collected primarily economic information, and the response rate was 61 percent. Sections C and D describe the results, while Appendix A contains the survey and a list of the companies contacted. Figures 1 and 2 show the locations of the firms.

To estimate the statewide economic activity associated with recycling manufacturers, the Regional Economic Models, Inc. (REMI) model was used. Total employment (which includes direct, indirect and induced employment), sales and tax revenue and value-added to the state economy were estimated using this model. A summary of the model's capabilities and the

OEA's analysis is contained in Appendix B. REMI defines value-added as the total contribution to Gross State Product analogous to GDP (gross domestic product) or output excluding the intermediate inputs (primarily, compensation and profit).

Specific information on the actual environmental benefits of Minnesota recycling manufacturers was limited or unavailable. For this section of the report, the OEA obtained general information by searching nationally available literature. In addition, information was obtained from a draft report on the resource conservation benefits of integrated solid waste management in the Twin Cities Metropolitan Area. (Tellus, 1997.)

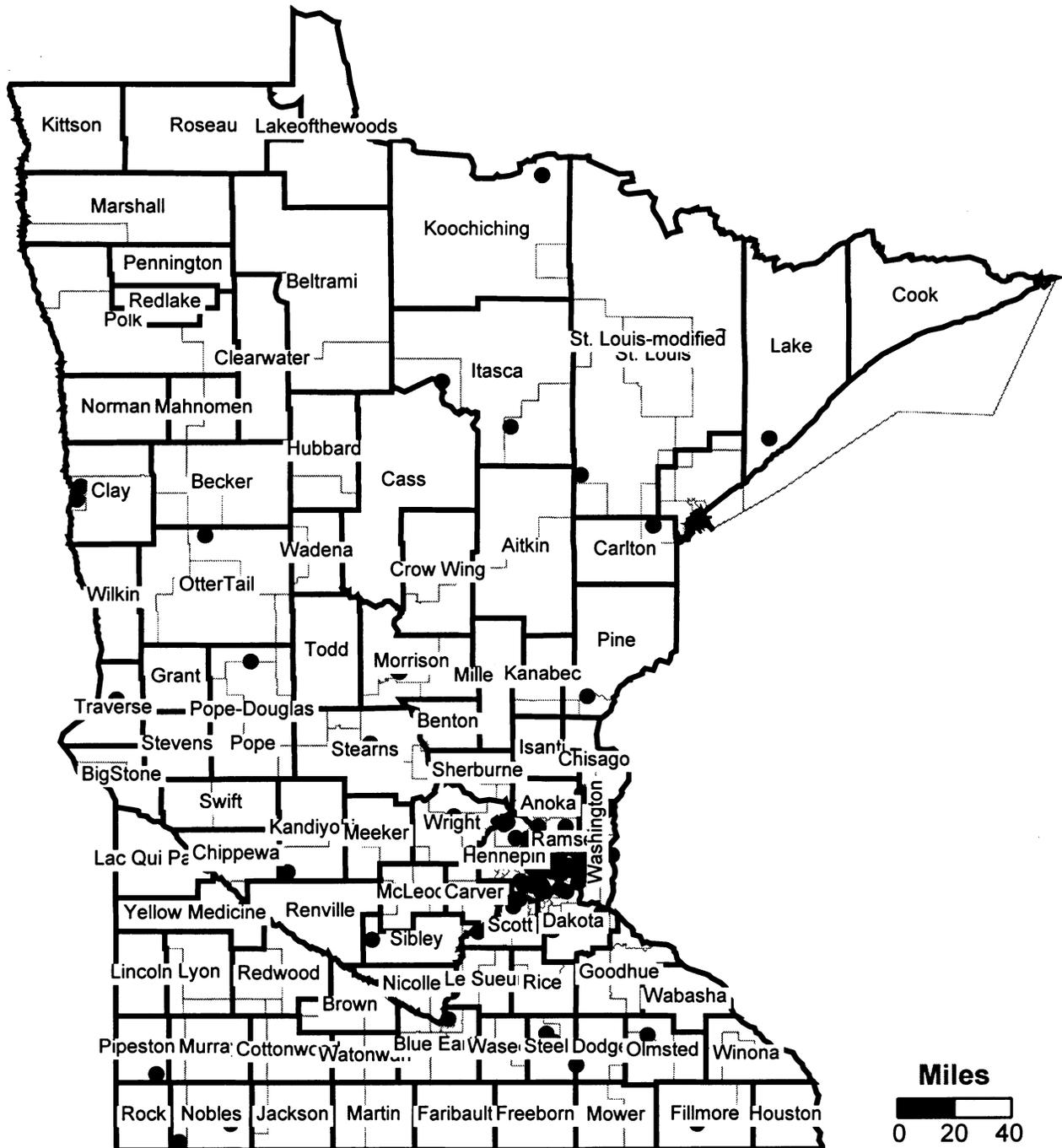
The OEA also developed three detailed business profiles, which can be found in Appendix C. These profiles provide insight into the development opportunities and barriers that these industries may face. They include examples of 1) a new recycled processing business; 2) an innovative recycled product manufacturer; and 3) an emerging start-up business.

## Summary Of Results

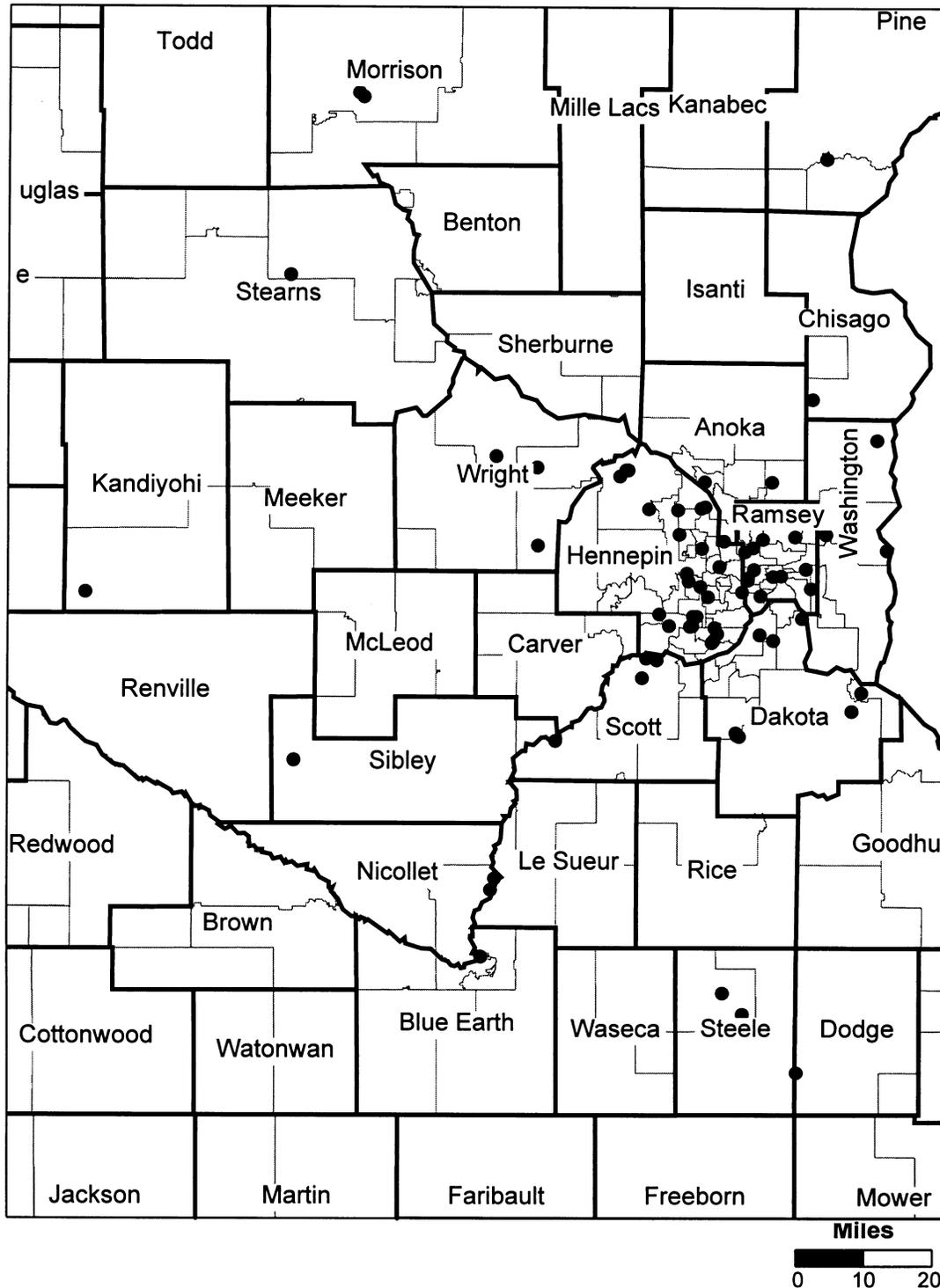
Minnesota manufacturers who use recycled feedstock contribute substantial economic benefits to the state. Based on the survey results and estimates derived from the 1996-97 American Business Directory, these companies employed an estimated 8,700 people and had sales estimated at nearly \$1.5 billion. Many indicated international as well as local sales. The REMI model estimated total value-added to the economy at \$1.3 to \$1.9 billion and total employment (which includes direct, indirect and induced employment) at 18,000 to 26,000 people. Finally, the companies generated state tax revenues between an estimated \$40 to \$66 million.

On the environmental side, these manufacturers use materials that otherwise would have been landfilled or incinerated. Based on national studies of the recycling industry and preliminary studies of the Twin Cities metropolitan solid waste management system, manufacturing with recycled materials has the potential to conserve materials, lower energy use and decrease emissions of pollutants when compared to manufacturing with virgin materials.

# Figure 1. Location of Value-Added Manufacturing Businesses by District



# Figure 2. Location of Value-Added Manufacturing Businesses by District



## Chapter 2. Economic Profile

### Recycled Material Supplies

Minnesota's recycling rate is one of the highest in the nation. In 1995, the state recycled 45 percent of its municipal solid waste (MSW), which is about 1.6 million tons of material. (Table 1.) In addition to MSW, non-MSW materials are also recycled. They include items such as automobiles, industrial scrap metal and concrete.

### Recycled Feedstock Demand

Of the 90 Minnesota-based manufacturers contacted for the survey, 41 responded to questions regarding feedstock demand. They reported using about 2 million tons of recycled feedstock in 1996. This recycled feedstock consisted of approximately 1.2 million tons of metals, asphalt, or concrete and over 600,000 tons of various paper grades.

To illustrate the trend in the demand for recycled feedstock in Minnesota, one can look at old corrugated containers (OCC). The state's capacity to utilize recovered OCC has increased 26 percent since 1993. Nearly three-fourths of the OCC recovered in Minnesota in 1995 was utilized by Minnesota recycled-product manufacturers. (Sure Green, Inc. and Lynne Bly and Associates, 1994.)

While much of the collected material is used by manufacturers within the state, substantial markets for materials also exist outside of Minnesota. Variations in commodity supply and demand and associated changes in material prices influence the regional and international commerce of these materials.

Many companies responding to the OEA survey have the potential to increase their use of recycled feedstocks. About 44 percent of the survey respondents indicated additional available capacity, with the total exceeding 325,000 tons. The largest amount of additional available capacity is for metals followed by plastics, wood and wood products.

The Assessment of Recycling Capacity for End Markets Serving Minnesota provides historical and regional context for the survey data. (Sure Green, Inc. and Lynne Bly and Associates, 1994.) According to this assessment, in 1987, multi-state regional market capacities for 29 material commodities were approximately 5.3 million tons, and 94 percent of the available capacity was utilized. Of the total capacity available, close to 1.1 million tons (approximately 24 percent) was located in Minnesota. In 1993, the regional end market capacity for 32 material commodities totaled 15 million tons, and 85 percent of that capacity was being utilized. The companies reported accepting materials not only from Minnesota, but from states as far away as California.

<b>Table 1. Municipal Solid Waste Collected for Recycling in Minnesota</b>					
<b>(in tons)</b>					
<b>Material</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995<sup>1</sup></b>
Paper	335,548	439,857	487,373	602,649	608,832
Metal	136,291	205,474	240,755	216,137	276,528
Glass	68,337	83,547	91,178	108,813	103,891
Plastic	11,187	20,949	23,145	27,224	34,072
Organics <sup>1</sup>	53,079	410,872	429,175	462,616	
Problem Materials		79,291	71,077	72,041	76,897
Textile and Carpet		4,303	3,647	8,251	8,987
Unspecified and Other	573,336	496,279	517,619	512,925	569,933
<b>Total</b>	<b>1,179,769</b>	<b>1,742,564</b>	<b>1,865,962</b>	<b>2,012,650</b>	<b>1,604,238</b>

<sup>1</sup>1995 figures do not include yard waste

**Table 2. Reported Annual Feedstock Usage.**

Feedstock Type	Annual Amount				
	Pounds	Board Ft.	Square Ft.	Gals.	Units
Newspaper	12,120,000				
Cloth	23,000,000				
Plastic	15,620,000				
Glass	5,100				
Metals <sup>1</sup>	1,432,042,000				
Corrugated or liner board	218,000,000		100,000,000		
Wood and wood products	5,050,000	750,000			
Rubber and rubber products	5,150,000				
Asphalt and concrete	1,000,000,000				
Solvents and fluids	2,700,000			6,050	
Misc. or mixed paper grades <sup>1</sup>	1,044,382,000				
Fluorescent lamps <sup>1</sup>					7,900,000
Empty toner cartridges					20,000
Other/unspecified	710,000				

<sup>1</sup>Totals include feedstock processed (prepared) for use by other manufacturers. For metals, the total processed is 320,000,000 pounds.; for misc. or mixed paper grades, the total processed is 280,000,000 pounds.; for fluorescent lamps, the entire amount represents processed material. The processed metals are not sold to end markets in Minnesota markets; portions of the processed paper and lamps are sold for use in Minnesota.

<b>Table 3. Reported Additional Unused Capacity</b>			
<b>Feedstock Type</b>	<b>Additional Annual Capacity Available</b>		
	<b>Pounds</b>	<b>Gals.</b>	<b>Units</b>
Newspaper	1,000,000		
Cloth	11,000,000		
Plastic	3,6000,000		
Glass			
Metals <sup>1</sup>	580,000,000		
Corrugated or liner board			
Wood and wood products	14,850,000		
Rubber and rubber products	3,250,000	9,500	
Asphalt and concrete			
Solvents and fluids	3,700,000		
Miscellaneous or mixed paper grades	4,618,000		
Fluorescent lamps <sup>1</sup>			2,100,000
Empty toner cartridges			3,000
Other/unspecified			

<sup>1</sup>All of the additional lamp capacity is for processing; 400,000,000 lbs. of the metals capacity is for processing for further use as a feedstock.

## Products Manufactured

Minnesota companies produce a wide array of products using recycled materials. Some products are well established, while others are relatively new to the market.

Table 4 summarizes the products sent to the market in 1996. The table is a conservative estimate of the types and numbers of products actually produced. While many companies produce more than one product, the OEA survey only requested information on a respondent's primary product or product line. A few companies chose to provide information on two products.

## Sensitivity to Changes in Feedstock Prices and Availability

To determine the level of dependency that manufacturers have on recycled feedstocks and their sensitivity to changes in feedstock prices, the survey asked respondents:

“If you stopped using recycled feedstock in the manufacture of this product and switched to virgin materials feedstock, how would it change your production costs?”

- 1) It would increase costs,
- 2) It would not affect costs,
- 3) It would decrease costs, and
- 4) Don't know.”

Half of the companies surveyed (including the respondents and non-respondents) did not answer this question. Of the 42 companies that answered this question, 34 (or 81 percent) indicated that switching to virgin materials would increase production costs. (Figure 3.)

This finding is important because a common perception is that production costs using recycled feedstocks is higher than using virgin materials. According to the survey results, this frequently is not the case.

Regarding the effect of a decrease in the availability of recycled feedstock, the survey asked:

“If recycled feedstock were not available, how would it change your business?”

- 1) Business would close,
- 2) Business would switch to virgin materials easily,
- 3) Business would switch to virgin materials, but substantial new capital investments would be needed.”

Twenty-two businesses indicated that they would close if recycled feedstock was not available. Fifteen percent of the respondents answering the question indicated that substantial capital investments would be needed to switch to virgin material feedstocks, while 34 percent indicated they could switch to virgin material feedstocks easily. (Figure 4.)

As in Figure 3, the “no answer” column includes both non-respondents and respondents who chose not to answer this particular question. Since some companies' answers are unknown, the number of companies adversely affected by feedstock loss could be higher. However, even without those responses, the reported closures are significant, involving estimated annual sales of nearly \$320 million and the employment of nearly 1,300 people.

## Contribution to State Economy

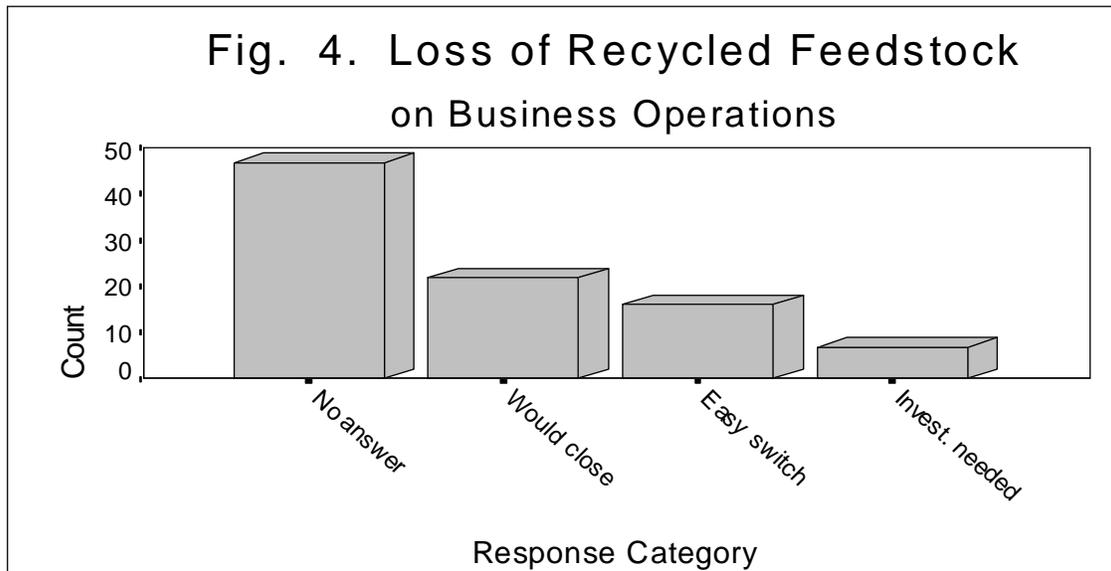
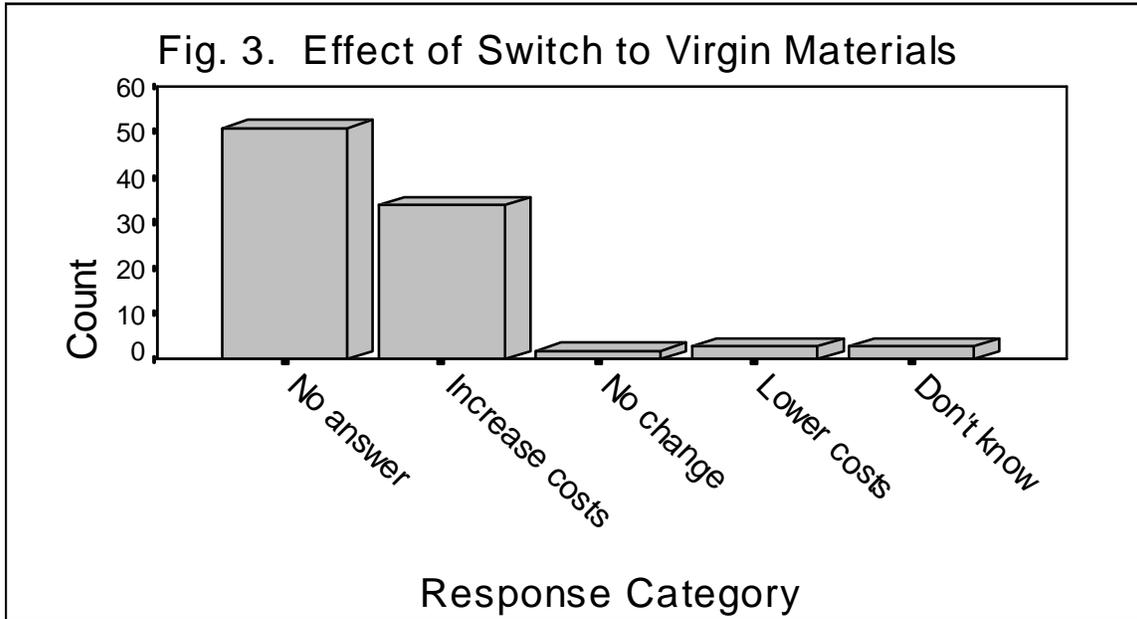
### Background: The Manufacturing Sector in Minnesota

To place the economic contribution of recycling manufacturers in context, it is useful to describe Minnesota's manufacturing sector as a whole. Manufacturing is an important part of the state's economy. Overall, it ranks third in employment, following the services and retail trade industry. In 1994, Minnesota's manufacturing sector employed approximately 415,000 people. (Minnesota Department of Trade and Economic Development, 1996 and 1997.) The largest industries were industrial machinery, printing and publishing, food and kindred products, and instruments and related products.

Slightly more than 8,000 Minnesota firms are classified as manufacturers. Two-thirds are small companies that employ less than 20 people. However, most employment occurs at larger firms. Medium sized firms (those with 100 to 499 employees) employ approximately 36 percent of the manufacturing employees, while large firms (those with 500 or more employees) employ about 35 percent.

The number of manufacturing firms in Minnesota increased by 16 percent (nearly 1,200 firms) between 1985 and 1993. (MOEA staff conversation with Nathan Tiller, Minnesota Department of Trade and Economic Development, April 1997.) Based on employment figures from 1985 to 1994, the fastest growing manufacturing industries were food and kindred products, transportation equipment, electric lighting and wiring equipment and medical instruments and supplies. (Minnesota Department of Trade and Economic Development, 1996.)

<b>Product Category</b>	<b>Reporting Frequency</b>
Building materials	10
Landscaping materials; playground equipment	7
Packaging materials	6
Office supplies	5
Solvents and other fluids	5
Fibers (cloth, carpet, etc.)	4
Processed feedstock	4
Other	4
Piping and associated supplies	3
Apparel	2
Pottery	1
Road construction materials	1
Molds and castings	1

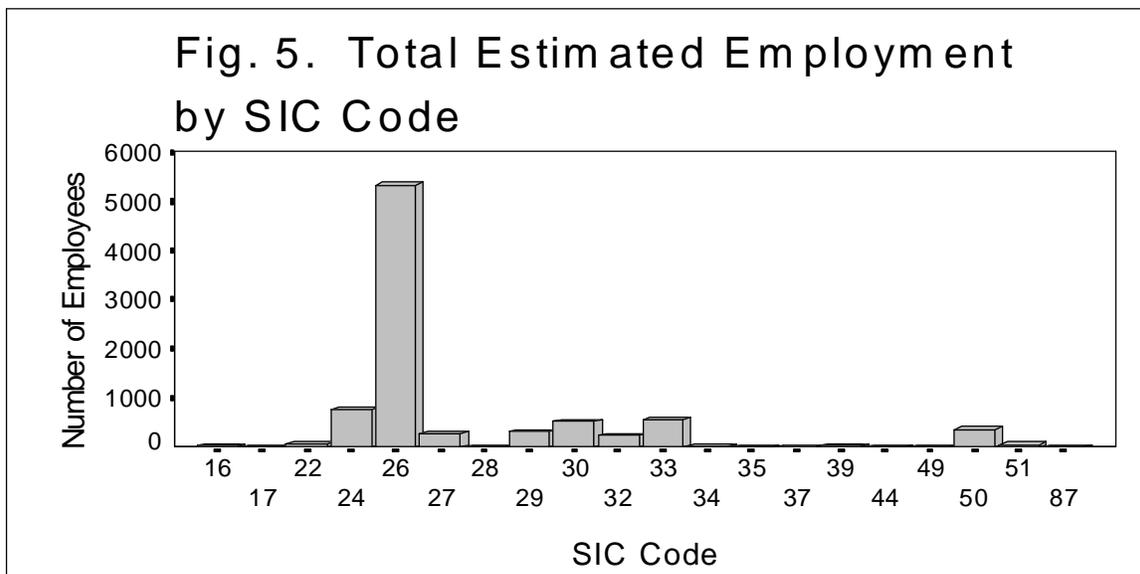


### Employment by Manufacturers that use Recycled Feedstock

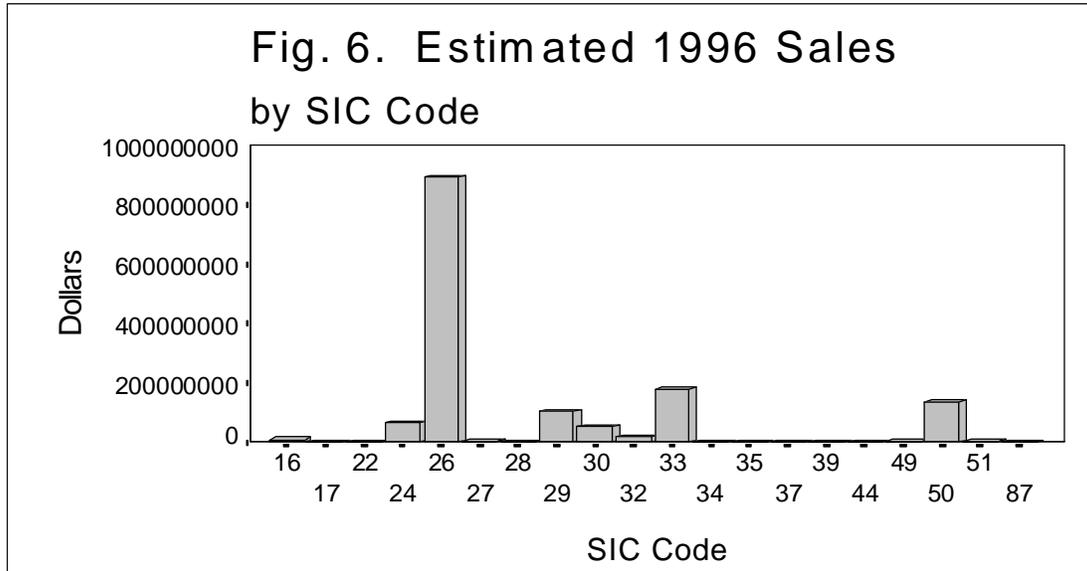
Manufacturers that use recycled feedstock employ a significant number of people. Survey respondents reported nearly 6,200 employees, and the estimated total number of employees exceeds 8,700. The OEA developed the estimated total number of employees by combining reported employment for respondents with the lower range of employment estimates from the 1996-97 American Business Directory for non-respondents.

The estimated number of employees in the recycling manufacturing industry exceeds the number of people employed in the communications services and communications equipment sectors, which are considered important and rapidly growing industries in Minnesota. The highest rate of employment (over 5000 jobs) occurs in Standard Industrial Classification (SIC) Code 26, paper and allied products. (Figure 5 and Table 5.)

Approximately 50 percent of the jobs reported in the recycling industry are skilled manufacturing positions, 35 percent are non-skilled manufacturing positions, 10 percent are office or clerical positions and 5 percent are managerial positions. If this distribution holds true for total estimated employment, the result is approximately 391 jobs in management, 784 jobs in office or clerical positions, 4,445 jobs in skilled manufacturing and 3,059 jobs in unskilled manufacturing.



<b>Table 5. Estimated Direct Employment, by SIC Code</b>		
<b>SIC Code</b>	<b>Description</b>	<b>Employment (to the nearest 100 employees)</b>
16	heavy construction, excluding buildings	100
17	special trade contractors	less than 100
22	textile mill products	100
24	lumber and wood products	800
26	paper and allied products	5300
27	printing and publishing	300
28	chemicals and allied products	less than 100
29	petroleum and coal products	300
30	rubber and miscellaneous plastic products	500
32	stone, clay, and glass products	300
33	primary metal industries	600
34	fabricated metal products	less than 100
35	industrial machinery and equipment	less than 100
39	miscellaneous manufacturing industries	less than 100
44	water transportation	less than 100
49	electric, gas, and sanitary services	less than 100
50	wholesale trade, durable goods	400
51	wholesale trade, non-durable goods	100
87	engineering and management services	less than 100



## Revenue Generated

### Estimated Sales Revenue

Survey respondents reported recycled product sales exceeding \$911 million. Adding sales estimates for non-respondents increases the total to nearly \$1.5 billion. As with employment estimates, most sales occur in SIC Code 26, paper and allied products. (Figure 6)

Many of the surveyed manufacturers purchased their feedstock from Minnesota sources. This activity contributes to the viability of Minnesota’s recycling efforts by creating local end markets, reducing transportation costs and increasing value-added to the state’s economy. In addition, many companies export finished products across state boundaries.

Of the 50 companies responding to questions about location of sales, two-thirds reported selling products internationally. These exports contribute to the state’s base of economic

activity. Their relative importance also suggests a potential for actual job loss in Minnesota should the companies close. If the primary market for manufacturers is local, another company will often expand its local market share if a competitor closes. However, if a company having substantial markets out-of-state closes, it is less likely that another local competitor will fill the market void. In this case, it is more likely that an out-of-state competitor will capture the market share of the Minnesota company that closed its doors.

## Estimated Tax Revenue Generated

The OEA estimates that recycled manufacturing businesses contribute between \$40 and \$66 million in annual taxes to the state. Although this amount does not include property taxes, it does include:

- Individual state income tax on employee's earnings.
- State sales tax.
- State excise tax.
- Corporate franchise tax.
- Sales tax on capital equipment, and
- Sales tax on non-capital equipment.

The OEA estimated individual and corporate taxes separately, using information derived from the REMI model and from the 1995 Minnesota Tax Incidence Study. (Minnesota Department of Revenue, 1995.) Appendix B describes the methodology used to estimate tax revenues

## Private Investment

Forty-one companies reported investing in equipment and buildings from 1994 through 1996. These investments exceed \$177 million. Estimates of capital investments made by non-reporting companies were not calculated.

## Influence on Statewide Economic Indicators

According to results obtained using the REMI model, the level of economic activity associated with recycled manufacturers is substantial. (Table 6 and Appendix B.) The obtained results do not draw conclusions about the potential economic impact if all the recycling manufacturers closed or estimate potential actual job loss if all the manufacturers closed.

For the subset of companies indicating that they would close if recycled feedstock was not available in Figure 4, the OEA calculated the potential economic impact. The results assume that displaced manufacturers are not replaced by competing companies within the state. Based on the high level of reported exports, this assumption is believed to be reasonable. The closure of these companies has the potential to affect more than 3,000 jobs and nearly \$6 million in tax revenues. (Table 7.)

<b>Table 6. Estimates of 1996 Economic Activity Associated with Minnesota's Value-Added Recycling Manufacturers</b>		
<b>Economic Activity Indicator</b>	<b>Based on Reported Employment</b>	<b>Based on Total Estimated Employment</b>
<b>Direct Jobs</b> (employment at the recycling manufacturers)	<b>6,200</b>	<b>8,700</b>
<b>Estimated Indirect Jobs:</b> Impacts on local suppliers statewide, unadjusted for displacement effects	<b>6,600</b>	<b>9,800</b>
<b>Estimated Induced Jobs:</b> Long term effects on personal income and consumer spending, localized and statewide	<b>5,300</b>	<b>7,400</b>
<b>Total Estimated Job Impact:</b>	<b>18,100</b>	<b>25,900</b>
<b>Total Estimated Wages and Salary Disbursements:</b> The monetary remuneration of employees, including compensation of officers, commissions, tips, and bonus and receipts-in-kind that represent income to the recipient.	<b>\$548 Million</b>	<b>\$772 Million</b>
<b>Total Estimated Tax Revenue:</b> Business/personal state income taxes, sales tax, excise tax and miscellaneous taxes excluding real estate taxes	<b>\$40 Million</b>	<b>\$66 Million</b>
<b>Total Estimated Value-added Activity:</b> Contribution to Gross State Product analogous to GDP(gross domestic product); output excluding the intermediate inputs (primarily compensation and profit)	<b>\$1.33 Billion</b>	<b>\$1.92 Billion</b>
<b>Total Estimated Gross Economic Activity:</b> Amount of production in total sales, includes intermediate goods purchased as well as value-added (compensation plus profit)	<b>\$2.94 Billion</b>	<b>\$4.51 Billion</b>

Source: Scenarios calculated using the Regional Economic Models, Inc. (REMI) Minnesota Forecasting and Simulation Model, February 1997, OEA

<b>Table 7. Potential Impact of Closure of Companies who Indicate a High Level of Dependence on Recycled Feedstock</b>	
<b>Direct Jobs at the Companies</b>	1300
<b>Estimated Indirect Jobs:</b> Impacts on local suppliers statewide, unadjusted for displacement effects	1000
<b>Estimated Induced Jobs:</b> Long term effects on personal income and consumer spending, localized and statewide	900
<b>Total Estimated Job Impact:</b>	3200
<b>Total Estimated Wages and Salary Disbursements:</b> The monetary remuneration of employees, including compensation of officers, commissions, tips, and bonus and receipts-in-kind that represent income to the recipient	\$86 Million
<b>Total Estimated Tax Revenue:</b> Including business/personal state income tax's, sales tax, excise tax and misc. taxes excluding real estate taxes	\$5.7 Million
<b>Total Estimated Value-added Activity:</b> Contribution to Gross State Product analogous to GDP(gross domestic product); output excluding the intermediate inputs (primarily compensation and profit)	\$183 Million
<b>Total Estimated Gross Economic Activity:</b> Amount of production in total sales, includes intermediate goods purchased as well as value-added (compensation plus profit)	\$396 Million

Source: Scenarios calculated using the Regional Economic Models, Inc. (REMI) Minnesota Forecasting and Simulation Model, February 1997, OEA

Several other state and local governments have analyzed the economic activity and impact of the recycling industry and have found similar results. ( Florida Dept. of Commerce, Feb. 1996; King County Department of Natural Resources, Solid Waste Div., May 1996; Roy F. Weston, Aug. 1996; R. W. Beck, et al., 1997.) An example is the analysis of North Carolina’s recycling industry. (Kirkpatrick, et al., July 1995.)

While this study focuses solely on recycling manufacturers, the North Carolina study included recycling collection and processing firms, public sector employees and an expanded characterization of recycling manufacturing industries. North Carolina estimated that its recycling industry employs over 8,800

employees and has estimated sales of \$945 million.

## Assistance from Public Agencies

### Direct Financial Assistance from Public Agencies

Survey respondents were asked to provide information on public grants they received, beginning in 1991, for the development, manufacture or distribution of their product with recycled content. The companies reported receiving \$1 million in loans and about \$1.8 million in grants. (Table 8.)

<b>Source of Grant</b>	<b>Award</b>
AARCC (Alternative Agricultural Research and Commercialization Center, USDA) <sup>1</sup>	\$1,000,000
DTED (Minnesota Department of Trade and Economic Development)	\$750,000
MOEA/OWM	\$655,000
United Soy Board	\$250,000
AURI (Agricultural Utilization Research Institute)	\$100,000
Five-year Total	\$2,755,000

<sup>1</sup>This was a “repayable cooperative agreement,” a type of loan

## Other Support

State, county and other public agencies may support the manufacturers through grants, loans and other types of direct financial assistance. This type of support is illustrated in Table 8.

Companies may also receive financial assistance indirectly. For example, grants are distributed to local governments to promote recycling and develop the recycling infrastructure, and local subsidies distributed to recyclable materials collectors may affect manufacturers. For instance, if a collector's accrued cost savings are passed along to manufacturers in the form of lower feedstock purchase prices, the manufacturer receives the benefit of the financial assistance.

Similarly, government efforts that encourage generators to recycle could indirectly benefit manufacturers if collection efforts increase the local supply of recyclables, and subsequently,

decrease the costs associated with obtaining feedstock. This type of indirect support is not unique to recyclables; it can affect any industry where government influences the market, including virgin materials markets. The influence of indirect financial support is difficult to assess, but it should be noted that SCORE grant expenditures for recycling are far below the estimated gross sales of the recycling manufacturing businesses.

In addition to financial assistance, technical assistance also benefits companies. Direct technical assistance to recycling manufacturers is relatively common. More than half (over 60 percent) of the companies that answered the survey question regarding contact with the OEA, replied that they have used the office's services. Of those companies, nearly 70 percent rated the assistance as a "4" or "5" on a scale from 1 (low) to 5 (high). Table 9 summarizes the types of assistance companies reported receiving.

<b>Assistance Type</b>	<b>Number of Companies</b>
Educational Materials	14
Phone Assistance	14
Financial	13
Attending OEA Workshops and Conferences	10
On-site Technical Assistance	7
Other OEA Assistance	5

## Chapter 3. Environmental Benefits

The OEA's survey of Minnesota manufacturers focused on economic, rather than environmental issues. At this time, detailed and specific information on the environmental benefits of Minnesota's recycling manufacturers is not available.

Nevertheless, national literature and a study of the resource benefits of integrated solid waste management in the Twin Cities metropolitan area provide evidence of environmental benefits derived from the use of recycled materials, rather than virgin materials, for manufacturing feedstock. This section of the report summarizes the findings of this literature.

While recycling's most significant environmental benefit is often characterized as landfill diversion, greater benefits tend to come from avoided materials consumption, energy savings and pollution prevention. These benefits can be accrued by avoiding the extraction and transportation of virgin materials or during product manufacturing, consumption and waste management activities.

### Avoided Materials Consumption

By its nature, the use of recycled materials for manufacturing avoids the development and use of virgin materials. As shown in Table 1, Minnesotans collected nearly 2 million tons of

recycled material in 1995. Most of these materials went to market and were used to manufacture products that would have otherwise incorporated virgin materials.

### Avoided Energy Consumption

When recycled materials, rather than virgin materials, are used to manufacture new products, substantial energy can be saved. These savings occur because energy is not used to extract or transport virgin materials and because energy requirements of some manufacturing processes using recycled feedstock are lower than those that involve virgin materials. Several examples illustrate the potential savings:

- **Aluminum:** Using one ton of aluminum instead of one ton of virgin aluminum reduces energy requirements by 150 million Btu. Aluminum cans recycled into new cans through a closed-loop process saves 94 percent of the energy required to produce aluminum cans from ore. (National Recycling Coalition.)
- **Paper:** The Natural Resources Defense Council (NRDC) estimates that 2.3 to 4 barrels of oil are conserved by recycling one ton of paper.

- **Glass:** The Glass Packaging Institute estimates that for each 10 percent increase in the manufacture of recycled glass cullet energy consumption decreases 2.5 percent. (Glass Packaging Institute, June 1996.)
- **General Energy Requirements:** A study by the Franklin Associates for the “Keep America Beautiful” campaign estimated that at least \$187 worth of electricity, petroleum, natural gas and coal are conserved by recycling one ton of materials in a typical curbside program. (Franklin Associates, 1994.) The study estimates that the reduction of energy used in manufacturing from using a ton of recycled materials instead of virgin materials is 18.3 million British thermal units (Btu).

In addition to energy savings associated with the avoided extraction and use of virgin materials, the Environmental Defense Fund (EDF) reports that recycling produces energy savings over other types of waste management. (Environmental Defense Fund, February 1995.) For instance, the EDF reports that recycling provides a net reduction in energy consumption that is 3.6 times greater than the amount of energy generated by incinerating MSW. Furthermore, recycling was reported to produce a net reduction in energy consumption 11 times greater than the energy generated by recovering methane from a landfill.

## Avoided Emissions of Air and Water Pollutants

Although using recycled material does not guarantee lower emission of pollutants, in many cases, lower emissions result. After accounting for all of the activities associated with recycling, one study found that for 10 major categories of

air pollutants and eight major categories of water pollutants, curbside recycling results in a net reduction in all pollutant categories, relative to a system based on virgin materials manufacturing. (Franklin Associates, 1994.) Furthermore, it is estimated that pulping waste paper rather than virgin wood utilizes 50 percent less water.

Preliminary results from a study of the Twin Cities metropolitan area, conducted by the Tellus Institute for the OEA, also indicate a net emissions benefit associated with the use of recycled, rather than virgin materials. (Tellus, 1997.)

In comparison to landfilling, recycling avoids leachate and methane gas generation. Leachate, a contaminated liquid formed when water comes into contact with wastes in a landfill, contains constituents that can pollute ground water. Even when collected, leachate requires expensive treatment.

Landfills also generate air emissions. Two sources include: 1) the working face of the landfill, where crushed or punctured items such as fluorescent tubes may release mercury and punctured aerosols may release hazardous household chemicals, 2) methane and other gases generated as wastes decompose. Uncontrolled emissions of methane, as well as carbon dioxide released when controlled methane emissions are burned, contribute to global warming.

Minnesota has worked diligently to clean up old leaking landfills and, through better monitoring and engineering, prevent modern facilities from polluting the air and ground water. Such care is costly and will likely increase over time. For example, current estimates indicate that cleaning up the state’s old closed landfills will cost several hundred million dollars. These cleanup

costs, as well as the long-term monitoring and control of newer landfills, result in long-term liability to Minnesota communities, businesses and taxpayers.

Recycling may also present advantages over MSW processing since Refuse-Derived Fuel systems and waste-to-energy facilities result in air emissions. In addition, they require the landfilling of ash from the combustion and residuals from processing.

## **Avoided Landfilling and Use of Land for Extraction and Production**

Landfills require long term use of land and can have long-term environmental impacts. For this reason, communities often maintain a “not in my back yard” view of landfills. Recycling helps avoid these environmental and political difficulties by minimizing the need for landfilling. For example, the Tellus Institute estimates that in 1995 recycling in the Twin Cities Metropolitan Area avoided 21.5 acres of landfilling. (Tellus, 1997.)

In addition, recycling helps avoid landfilling associated with virgin materials extraction and preparation and land use for production purposes. According to the Tellus study, in 1995, the Twin Cities Metropolitan Area recycled 647,000 tons of paper. If virgin materials were used for production instead, it would have required the harvest of 323,000 acres of forest. (Tellus, 1997.) An unspecified amount of mining was also avoided.

Finally, industrial process wastes can be reduced when recyclable materials are substituted for virgin raw materials in manufacturing processes. According to some sources, approximately one pound of process wastes are avoided for every two pounds of recyclable material used in place of virgin materials.

## Chapter 4: Business Opportunities and Barriers

Gaining economic and environmental benefits for recycling is dependent upon many factors. Those factors include public support, an effective recycling infrastructure (including collection and processing systems), a regional demand for recycled materials by manufacturers and a strong consumer market for recycled products (especially for products containing post-consumer content). Briefly described is how two of the factors, public support and the recycling infrastructure, support Minnesota manufacturers. Some of the challenges facing these businesses are also described.

### Public Support

In Minnesota, the high level of citizen support for recycling is reflected in the state's Waste Management Act (WMA). The WMA sets source reduction and recycling goals, requires recycling implementation strategies in county solid waste management master plans, establishes minimum recycling opportunity standards and establishes a major grant program (SCORE) to fund local recycling efforts.

The SCORE grant program is funded through a 6.5 percent sales tax levied on all retail sales of solid waste collection and disposal services. The Department of Revenue estimates that SCORE raises approximately \$26 million per year. Approximately \$19 million is appropriated annually to fund recycling activities throughout the state; of that, \$14 million is earmarked as

block grants to counties. To be eligible for the block grants, counties must provide a 25 percent local funding match.

In addition to the county block grants, some SCORE revenue is dedicated to recycling market development grants and loans. These grants and loans help spur the expansion of the state's recycling manufacturing industry. Since 1991, the OEA has provided \$2.8 million in loans to manufacturing firms using recycled feedstock and \$2 million in grants to study and promote the use of recycled materials.

Using SCORE revenue, the OEA also provides a wide variety of technical assistance to recycling businesses. The Recycling Market Development Assistance Program helps emerging recycling manufacturers and existing manufacturers modify their operations to use recycled feedstocks.

In addition, the OEA collaborates with other state and federal agencies to provide business development assistance. Past OEA partners include the United States Environmental Protection Agency and the Minnesota Department of Trade and Economic Development.

## Infrastructure Characteristics

Efficient collection, processing and transportation systems for recyclable materials are critical to the vitality of recycling manufacturers. These systems help assure new and existing companies that their feedstock demands can be reliably and consistently met.

Most Minnesota communities contract with private collection businesses for residential recycling services. As of 1995, 3.4 million Minnesotans in more than 700 cities were served by curbside recycling programs. In addition, 670 recycling centers and 622 recycling stations provide recycling opportunities to other residents. Many businesses contract directly with haulers for recycling services.

Conversely, Minnesota manufacturers create diverse local end-use markets for collected recyclables and help to stabilize the collection and processing infrastructure. These manufacturers create a more stable demand for collected materials, reduce transportation costs to market and help limit cyclical price fluctuations.

## Challenges to Business Development and Operation

Although Minnesota has made great progress in recycling, diminished local government budgets and fluctuations in the market price for recycled feedstocks pose challenges to manufacturers. In addition, some companies face a weak demand for their recycled-content products. The lack of demand can be attributed to several factors, including fluctuation in industry production cycles, cost competition from virgin materials and products, and a lack of public information about the availability and performance of recycled products.

Strong local recycling collection and manufacturing infrastructures, diverse local markets, quality value-added products, improved system efficiencies, incentives to use recycled feedstock and purchase recycled-content products, and emphasis on the economic benefits of recycling activities can help businesses face these challenges successfully.

## Chapter 5. Conclusions

Minnesota has one of the highest recycling rates in the nation. Manufacturers who use the collected materials as feedstock contribute substantial benefits to the state.

On the economic side, estimates derived from OEA survey data and The 1996-97 American Business Directory indicate that these companies employ 8,700 people and have sales of nearly \$1.5 billion. Many companies sell their products out-of-state as well as within the state.

Estimates based on REMI model results, indicate that the total value-added to the state economy is between \$1.3 to \$1.9 billion. Total associated employment (which includes direct, indirect and induced employment) is estimated between 18,000 to 26,000 people. In addition, the OEA estimates that these companies generate annual state tax revenues of \$40 to \$66 million.

Recycling manufacturers also contribute environmental benefits. Based on a search of national literature and a study of the Twin Cities Metropolitan Area, benefits include a decreased amount of material landfilled and incinerated, avoided consumption of virgin materials, decreased energy use, and decreased pollutant emissions. For instance, 2.3 to 4 barrels of oil are conserved by recycling one ton of paper, and in another case, recycling aluminum cans saves 94 percent of the energy required to manufacture new cans from ore.

Given the benefits, the state has an interest in encouraging the development of new recycling manufacturers and the survival of existing manufacturers. Furthermore, the state has an interest in protecting the recycling collection infrastructure, which provides essential support for recycling manufacturers.

## References

- American Business Information, Inc., American Business Directories Division. 1996-97 American Business Directory, Minnesota State, CD-ROM version. Omaha, Nebraska.
- Commonwealth of Massachusetts, Executive Office of Environmental Affairs, Department of Environmental Protection. July 1992. "Value-Added by Recycling Industries in Massachusetts." Boston, Massachusetts.
- Environmental Defense Fund. February 1995. "Advantage Recycle: Assessing the Full Costs and Benefits of Curbside Recycling." Washington, D.C.
- Franklin Associates, Ltd. September 1994. The Role of Recycling in Integrated Solid Waste Management to the Year 2000. Prepared for Keep America Beautiful. Stamford, Connecticut.
- Glass Packaging Institute. June 1996. Solid Waste and Recycling Policy.
- Florida Department of Commerce, Division of Economic Development. February 1996. Recycling Creates Jobs in Florida. Tallahassee, Florida.
- Institute for Local-Self Reliance. 1994. Recycling Economic Development Through Scrap-Based Manufacturing.
- King County Department of Natural Resources, Solid Waste Division. May 1996. Summary Report of 1995 Surveys of Washington State Recycled Material Collectors and Haulers, Transporters, Processors, and End-Users. Seattle, Washington.
- Kirkpatrick, David A., et al. July 1995. The Impact of Recycling on Jobs in North Carolina. Prepared for the North Carolina Department of Environment, Health and Natural Resources, Recycling and Reuse Business Assistance Center, Office of Waste Reduction. Raleigh, North Carolina.
- KirkWorks, et al. July 1996. North Carolina Environmental Business Study. Raleigh, North Carolina.
- Minnesota Department of Revenue. March 1995. 1995 Minnesota Tax Incidence Study-Who pays Minnesota's household and business taxes? St. Paul, Minnesota.
- Minnesota Department of Trade and Economic Development. 1997. Compare Minnesota An Economic and Statistical Fact Book 1996/1997. St. Paul, Minnesota.
- Minnesota Department of Trade of Economic Development. April 1997. telephone conversation between MOEA staff and Nathan Tiller. St. Paul, Minnesota.
- Minnesota Department of Trade and Economic Development. October 1996. Economic Activity and Economic Impact of the Snowmobile Industry in Minnesota. St. Paul, Minnesota.

- Minnesota Department of Trade and Economic Development. 1996. The Minnesota Economy at a Glance. St. Paul, Minnesota.
- Minnesota Office of Environmental Assistance. July 1995. Consolidated Solid Waste Report. St. Paul, Minnesota.
- Minnesota Office of Environmental Assistance. February 1995. Minnesota Recycled Product Directory. St. Paul, Minnesota.
- Minnesota Office of Environmental Assistance. July 1996. Report on Packaging Discards - 1996. St. Paul, Minnesota.
- New York State Department of Economic Development, Office of Recycling Market Development. 1996. Draft, A Recommended Recycling Economic Development Portfolio for New York City. Albany, New York.
- R. W. Beck, et al. 1997. Economic Impact of Recycling Study. Prepared for a joint venture of the Iowa Department of Natural Resources and Iowa Department of Economic Development. Des Moines, Iowa.
- Sure Green, Inc. and Lynne Bly Associates. 1994. Assessment of Recycling Capacity for End Markets Serving Minnesota. Prepared for the Minnesota Office of Waste Management. St. Paul, Minnesota.
- Tellus Institute. February 1997. A One-Year Snapshot: Resource Conservation Benefits Associated with 1995 MSW Management in the Twin Cities Metropolitan Area. Draft. Prepared for the Minnesota Office of Environmental Assistance. St. Paul, Minnesota.
- Treyz, George I. 1993. REGIONAL ECONOMIC MODELING- A Systematic Approach to Economic Forecasting and Policy Analysis. University of Massachusetts: Amherst, Mass.
- Weston, Roy F., Inc. August 1996. Economic Benefits of Recycling in the Southern States. Prepared for the Southern States Energy Board and the Southern States Waste Management Coalition. Norcross, Georgia.
- U.S. Environmental Protection Agency, Solid Waste and Emergency Response. May 1995. Municipal Solid Waste Factbook, v. 2.0. EPA530-C-95-001. Washington, D.C.

**APPENDIX A: MANUFACTURING BUSINESS SURVEY  
AND LIST OF COMPANIES CONTACTED**

**Background Information**

Business Name \_\_\_\_\_ Business Address \_\_\_\_\_

Plant Address \_\_\_\_\_ Additional Plant Address \_\_\_\_\_

Contact Name \_\_\_\_\_ Business Phone \_\_\_\_\_

Business SIC Code \_\_\_\_\_ Business Fax \_\_\_\_\_

—

**1. How many years has this company been in business?**

less than 3                      3 to 5                      6 to 10                      more than 10

**2. Does this company use recycled feedstock in any of its manufacturing processes?**    yes    no

If no, please stop here. Thank you!

**Product Information**

**3. How many different products do you manufacture that include recycled feedstock? \_\_\_\_**

**For your primary product that uses recycled feedstock , please provide the information requested in questions 4 to 6. If you manufacture more than one product that uses recycled feedstock, please answer questions 4 to 6 for your second most important product as well.**

**4. Please tell us about your product that uses recycled feedstock:**

**a. Please describe the type of product you manufacture:**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**b. Please briefly describe typical uses for this product:**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**c. What types of recycled feedstock does this product include, and how much do you use on an annual basis?**

Type of Feedstock	Annual Amount Used	Purchase Price	% of Total Production Cost

**d. How much capacity do you have available to use recycled feedstock in the manufacture of this product, on an annual basis?**

Type of Feedstock	Total Capacity Available

**e. Please give examples of how your use of recycled feedstock would change if the price of**

**the feedstock changed. Assume that the supply of feedstock available to you is unlimited.**

	No price change	10% price increase	10% price decrease	Other price change (identify)___	Other price change (identify)___
% Change in Use of Feedstock					

**f. About what % of your recycled feedstock was obtained from Minnesota sources?**

\_\_\_\_\_

**g. By weight, about what percent of your finished product is made of recycled material?**

\_\_\_\_\_

**h. By weight, about what percent of the recycled content is from post-consumer recycled materials? \_\_\_\_\_**

**i. Where is this product sold? (circle all that apply)**

locally                      state-wide                      multi-state region      nationally                      internationally

**j. What % of this product's sales last year were made to customers outside of Minnesota? \_\_\_\_\_**

**k. How many units of this product did you sell last year? \_\_\_\_\_?**

**l. Over the past three years (1994-1996), what has been your company's total capital investment in Minnesota for equipment and buildings related to the manufacture and**

**distribution of this product? (please do not include funds received from public grants)**

<b>Equipment</b>	\$
<b>Buildings</b>	\$

**m. Would this investment have been necessary if you were using virgin material feedstock instead of recycled materials feedstock? \_\_\_\_\_**

**n. What were your gross sales for this product last year, according to how the product was sold?**

<b>Sale Category</b>	<b>Gross Sales Total</b>
To wholesalers or distributors	\$
Directly to retailers	\$
Directly to product users	\$
<b>TOTAL SALES</b>	

**o. If you stopped using recycled feedstock in the manufacture of this product, and switched to virgin materials feedstock, how would it change your product costs?**

It would increase my costs      It would not affect costs      It would decrease costs      Don't know

**p. If recycled feedstock were not available, how would it change your business?**

Business would close      Business would switch to virgin materials easily      Business would switch to virgin materials, but substantial new capital investments would be needed

**5. Please complete the following table for all your employees dedicated to the production and distribution of the product described above.**

<b>Worker Classification</b>	<b>Number of Workers</b>	<b>Total Hrs All Employees Worked on Product Activities Last Year</b>	<b>Avg. Hourly Wage</b>
Managerial			
Office/Clerical			
Skilled Manufacturing			
Non-skilled Manufacturing			

**Assistance Information**

**6. If your company has received grants within the last 5 years from public agencies for the development, manufacture, or distribution of your product, please identify the amount, year, and source of funding.**

<b>Source of Grant</b>	<b>Amount</b>	<b>Year Received</b>

**7. Have you ever used OEA services in the past?      Yes      No**

*If you answered yes to question 7, please answer questions 8 and 9. If you answered no, please skip to question 10.*



**Accent LaserTone**

**M.E. International**

**ADO Products**

**MAT Inc.**

**Andersen Corp.**

**Miller Manufacturing co.**

**Aspen Research Corp.**

**MILSOLV Minnesota Corp.**

**Barton Sand & Gravel Co.**

**Monarch Plastic**

**Blue Skies Glassworks**

**National Polymers Inc.**

**Bro-TEX Inc.**

**North Star Steel**

**Consolidated Container**

**Northern Insulation Products**

**Coolant Recovery Co.**

**Organic Conversion Corp.**

**Duluth Timber Company Inc.**

**Performance Computer Forms**

**E Z Dock Inc.**

**Phenix Biocomposites**

**ECO I.D.**

**Phoenix Recycling Corp.**

**Energy Zone Mfg. Inc.**

**Plymouth Foam Products (closed)**

**Envirecycle Ink Recovery Ltd.**

**Prinsco Inc.**

**Environmental Rubber Product**

**Recyclights, Inc.**

**Evergreen Products Inc.**

**Renew Resources inc.**

**Foam Fabricators of Minnesota**

**RPM**

**Gopher Sign Company**

**Smead Manufacturing Co.**

**Gopher Smelting**

**Superior Recycled Fiber Corp.**

**Henderson Hardwoods (closed)**

**T & R Traders Ltd.**

**Hennepin Paper Co.**

**Tenneco Packaging**

<b>Imperial Custom Molding</b>	<b>Tilsner Carton co.</b>
<b>International Bildrite Inc.</b>	<b>Trash Depot Inc.</b>
<b>Ladtech, Inc.</b>	<b>United Recycling Inc.</b>
<b>Landscape Structures, Inc.</b>	<b>USG Interiors Inc.</b>
<b>LaserSharp, Inc.</b>	<b>Waldorf Corp.</b>
<b>Liberty Paper</b>	<b>Wirthco Engineering Inc.</b>
	<b>Wonder Industries</b>

**Additional Companies Contacted:**

<b>3M Carbonless Products</b>	<b>Nerman-Lockhart Inc.</b>
<b>3M Commercial Office Supply</b>	<b>OEI Business Forms</b>
<b>Anchor Glass Container Corp.</b>	<b>Pallet Recycling Div. / Otto</b>
<b>Blandin Paper Co.</b>	<b>Paul's Insulation Inc.</b>
<b>Boise Cascade</b>	<b>Perfecseal Mankato</b>
<b>Carlisle Plastics</b>	<b>Plymouth Foam Products</b>
<b>Ceres Environmental, Inc.</b>	<b>Poly Plastics Inc.</b>
<b>Certainteed Corp.</b>	<b>Potlatch Corp.</b>
<b>Crane Creek Construction Inc.</b>	<b>Premier Marine Inc.</b>
<b>Cross Pointe Paper Corp.</b>	<b>Raguse Mfg.</b>
<b>Deer River Hired Hands Inc.</b>	<b>Recycled Plastics Inc.</b>
<b>Fey Industries Inc.</b>	<b>Rollins Resources</b>

**Grappler Products - Div.**

**Safco products**

**Green Bay Packaging Inc.**

**Sign Solutions Inc.**

**Henderson Hardwoods**

**Spray Control Systems**

**Johnson Anderson & Asso.**

**Ultra Pac Inc.**

**Load-right Products Div.**

**Veesenmeyer Construction Inc.**

**Midwest Asphalt**

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## APPENDIX B: REMI MODEL ANALYSIS AND TAX CALCULATIONS

The REMI model, developed by George Treyz of Amherst, Massachusetts, builds economic forecasting and simulation models for national, state and county-based regions. It can simulate the economic and demographic effects of activities that influence an area's economy, such as construction and operation of new businesses, regulations, and public policies. It captures the detail of the economy, as well as key inter-relationships within it. (such as the response of the economy to new capital investment and new jobs created). Major divisions of the economy addressed by the model are:

- output by sector
- labor and capital demand
- population and labor supply
- wages, prices, and profits
- market shares.

In this particular project, a direct effect on the economy, specifically the employment added by manufacturers who use recycled feedstocks, was used to estimate the contribution of those businesses to Minnesota's economy.

To help determine how best to model the influence of the recycling manufacturers, the OEA worked not only with REMI staff, but also reviewed a number of existing studies of the economic contributions of recycling.

To develop reasonable estimates, the OEA ran a total of 12 different scenarios. In some scenarios, the OEA used employment reported by survey respondents; in others, the office used estimates of total employment for all companies in the survey sample. For survey non-respondents, the OEA used the 1996-97 American Business Directory as the source of information for estimated employment. In every case, the lower value of the employment range in the directory was used to obtain the estimate.

To assure that the model did not overestimate contributions to the economy, staff suppressed a number of features in the REMI model. The suppression approach followed an approach used by the Department of Trade and Economic Development in a study it conducted to estimate the contributions of snowmobile manufacturers to the state economy.

The OEA selected two scenarios to report the range of results in the text. Both scenarios used the suppression approach. In all cases, the lower end of the estimates used actual employment reported by survey respondents, while the higher values added estimated employment for non-respondents.

To calculate the individual tax estimates, the OEA used two approaches. First, the baseline REMI model forecast was used to obtain salary ranges by SIC code. The 1995 Tax Incidence Report, recommended by the Department of Finance as a reference, was used in calculating average tax burden by salary range. The average tax burden for each salary range was then multiplied by the number of employees in that particular salary range and SIC code. In the second tax approach, the OEA used information from a tax table generated by the REMI model during the scenario developed using estimated employment. These tax estimates include individual state income tax, state sales tax, state excise tax and other state taxes. They do not include property taxes.

## APPENDIX C: DETAILED CASE STUDIES

The results of the OEA's survey of recycling businesses was used as the foundation for much of this report. The results of the survey are presented in the aggregate, and give a broad picture of the industry as a whole.

The following case studies supplement the survey data. They are intended to provide the interested reader with a more detailed picture of selected individual companies.

### CASE STUDY 1:

#### NEW RECYCLING VALUE-ADDED PROCESSING BUSINESS

##### Company and Facility Locations

Recyclights, Inc.

401 West 86th Street

Bloomington, MN 55420

4972 Woodville Highway

Tallahassee, FL 32311

4220 Perimeter Drive

Columbus, OH 43228

##### Company Contacts

Keith Thorndyke, President & CEO

Phone: 800-831-2852

Fax: 612-948-0627

##### Type of Business

Recyclights is a private, for-profit corporation. The company receives, processes and recycles mercury-containing products. It adds value to these materials by using a special technology to recover mercury and other materials, which it then markets. The company's recovery operations provide an environmentally- friendly alternative to the disposal of products containing mercury.

**Company History**

Recyclights was incorporated in April 1992, and began processing on July 7, 1992, in Minneapolis, Minnesota. In November 1994, the company moved to a larger site in Bloomington, Minnesota. Recyclights has experienced continued growth since that time, establishing a Florida facility in August 1994 and an Ohio facility in August 1996. To date, the company has recycled over 17,000,000 lamps.

**Recycled Feedstock and Product Information**

Recyclights has licensed, regulatory approval as a hazardous waste generator. Its approvals allow it to recycle and store mercury-containing products and materials. The primary feedstock and material processed is fluorescent light tubes. The company is also beginning to accept other mercury-containing products.

Recyclight's primary function is to provide a recycling service for companies that want to get rid of mercury-containing products. Recyclight's service is important because it provides generators with an environmentally-responsible option to handle such products. Minnesota and other states have banned these products from landfilling or incineration because of environmental concerns.

The company receives fluorescent lamps from large generators, and charges them a per lamp tipping fee. Mercury, phosphor powder, glass and aluminum are recovered from the lamps.

The company provides an accountable service by tracking all orders, including sources and quantities, to verify the use of materials for recycling. This type of management provides generators with a lowered risk of future liability.

Recyclights plans to continue research and development activities, along with equipment and process modifications, to diversify its processing capabilities.

**Processing Capacity**

The company can process 10,000,000 fluorescent lamps per year and 250,000 pounds per year of other mercury-containing products. Within five states, Recyclights has the exclusive use of equipment developed by a Swedish company. It conducts ongoing improvements to meet specialized processing needs.

**Economic Information**

In 1996, total company revenue reached \$3.4 million; its Minnesota facility revenue was \$2.4 million. The sale of recycled material is a minor source of revenue, and brought in \$17,000. ; Tipping fees for lamps is the primary source of revenue, and accounted for all the remaining revenue. Currently, the company holds approximately 65 percent of the market.

The company sold recovered mercury to markets outside of the state. Most other materials were sold to markets within the state.

The company's total capital investment for equipment and buildings in Minnesota from 1994-1996 was \$1.4 million. The company estimates that it pays over \$100,000 per year in payroll taxes.

Currently, the company has 45 employees; 36 are located in Minnesota. Its skilled manufacturing workers earn nearly \$12 per hour, while its non-skilled workers average almost \$9 per hour. The company also employs marketing and sales personnel; it uses a team-based compensation system for those employees.

Recyclights also recycles its own pallets, cardboard and other transport packaging. Cost limitations prevent the company from obtaining additional materials outside the region.

**Environmental Impacts**

The company accounts for 42,000 pounds of mercury recovered annually. Recyclights has a firm environmental commitment to comply with existing environmental standards.

**Additional Information**

The primary concern for Recyclights is increased price competition for fluorescent lamps, which could cause a decrease in material supplies. The company's success is also threatened by competitors who cut costs by landfilling some materials.

## **CASE STUDY 2:**

### **INNOVATIVE RECYCLED PRODUCT MANUFACTURER**

#### **Company and Facility Locations**

Phenix Biocomposites, Inc.  
1511 Gault St.  
St. Peter, MN 56082

#### **Company Contacts**

Mike Riebel  
Phone: 507-932-9787  
Fax: 507-931-5573

#### **Type of Business**

Phenix Biocomposites, Inc. (PBI) developed and manufactures three biofiber-based products: Environ Biocomposite, NewStone and Biofiber. These products are used in flooring, awards, custom millwork, countertops and furniture substrates.

#### **Company History**

PBI was incorporated in June 1992 to develop and commercialize a new biocomposite technology for the Environ product line. PBI acquired the rights to the technology manufacturing process and other assets from Rho Delta, Inc., a research and development company composed of physics, engineering and technology faculty from Mankato State University in Mankato, Minnesota.

In November 1992, Environ was developed at a pilot plant in Mankato, along with a press manufacturing system that produced 2 feet by 2 feet panels. The first commercial production of Environ began in St. Peter, Minnesota, in June 1994.

Environ has gone through several formulation and production modifications. The company's organization, management and ownership structure has also evolved and continues to experience growth.

PBI, in conjunction with Phenix Manufacturing Co., Inc., held a groundbreaking ceremony for a second plant on November 27, 1996. PBI is responsible for the patent rights, marketing, and research and development, and Phenix Manufacturing is responsible for production.

#### **Feedstock and Product Information**

Environ Biocomposite is comprised of approximately 50 percent waste paper, primarily old newsprint along with other mixed grades. It is produced using a biocomposite particle technology. The particles are initially created from agricultural-based flours and fiberized cellulose. Currently, soybean flour is used as the main binder and is manufactured into a bioresin. Cellulose fiber derived from waste paper is

impregnated with the bioresin, then the mixture is formed into homogeneous composite particles. The material is currently thermoformed into sheets.

Environ Biocomposite simulates hardwoods and withstands traditional woodworking equipment and techniques. It looks similar to granite and has applications in furniture, flooring, millwork, custom fixtures, displays, store fixtures and wall systems. This product is available in 2 textures and 10 colors. It is sold in 3 feet by 6 feet sheets ranging in thickness from 1/8 inch to 1 inch.

NewStone, currently in the development stage, will use 60 to 100 percent recycled materials, composed of paper and polyethylene terephthalate (PET) plastic. It will be a polymer-particle fused-sheet product that will be used as an alternative to solid surface materials (for example, countertops). This product will be test-marketed in 1997.

Biofiber consists of 2 sheet products: an ultra-lightweight wheat-board and a soy-fiber particleboard. It is an alternative to particleboard. Both products are formaldehyde-free.

### **Manufacturing Capacity**

PBI built a pilot prototype development plant in St. Peter, Minnesota, in 1993. This facility enabled the company to develop and produce products for test-marketing.

In a joint venture between PBI and the Minnesota Soybean Growers Association, the Soybean Growers Cooperative was formed in 1994. The Cooperative raises capital for technical advancement and supplies soy materials for a full scale production facility.

In November 1996, the Cooperative began constructing a 200,000 square foot production facility. This full-scale plant is targeted for completion in May 1998. It will have 10 to 20 times the production capacity of the prototype facility and will manufacture Environ Biocomposite and Biofiber. PBI's total recycled material capacity for 1997 is approximately three million pounds. In 1998 when the new facility opens, the company's projected capacity will be 150 million pounds of paper and 100 million pounds of PET.

### **Economic Information**

In the past three years, PBI has invested over \$3 million in capital equipment in Minnesota, and the company will invest another \$15 to \$20 million in the new Minnesota Soybean Cooperative facility.

PBI has developed three material product lines for the furniture and construction markets. Currently, 80 percent of their primary product is sold nationally and internationally. In 1996, gross sales were over \$1.5 million.

Currently, PBI has 30 employees. Growth in employment is projected as the full-scale production facility opens in 1998.

### **Environmental Benefits**

The company's manufacturing process minimizes toxins and waste during production; the materials content of their products is environmentally-friendly; and their use of recycled materials presents a

potential for significant landfill abatement. In addition, products developed by the company provide an alternative to virgin hardwoods. The company's products also have the potential to displace products containing chemicals (for example, formaldehyde) that can have negative environmental impacts. Finally, the use of soy-based material provides an alternative market for a renewable agricultural product.

**Additional Information**

The products developed by PBI are innovative and new to the marketplace. Their market acceptance will continue to be a challenge, especially as they compete with other products. As market expansion occurs, additional production facilities are possible.

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### **CASE STUDY 3:**

## **EMERGING/STARTUP RECYCLING MANUFACTURING BUSINESS**

#### **Company and Facility Locations**

Monarch Plastic Processing, Inc.  
1100 4th Street NW  
Little Falls, MN 56345

#### **Company Contacts**

Jim Everly, Kevin Burt, David Dickmann  
Phone: 320-632-3625  
Fax: 320-632-0490

#### **Type of Business**

Monarch Plastic Processing, Inc., is a recycled products plastics injection molder and also reprocesses a variety of post-consumer plastic resins. The majority of its reprocessed plastics are molded into horticultural products, a handicapped swimming pool step (a proprietary product) and adjusting rings for highway construction. Unused reprocessed plastics are sold as commodity materials.

#### **Company History**

Monarch was founded in 1995 by three partners with over 75 years of combined experience in the plastics industry. It began processing plastics and manufacturing in early 1996 in a new building in Little Falls, Minn. The three principles designed the building and processing/manufacturing layout which consists of new and modified equipment.

#### **Feedstock and Product Information**

Monarch obtains and processes its own recycled plastic feedstocks. Its primary source of materials is the local community and other commercial generators. As material needs increase, the company will need to find additional sources of materials.

The company accepts a variety of post-consumer plastics for processing, but currently uses only high density polyethylene (HDPE) and polypropylene (PP) in its manufacturing processes. It markets other resin types as feedstock for other companies.

Monarch injection molds a number of recycled plastic products. The company initially developed a proprietary handicapped pool step system which it is in the early stages of marketing. It also has a horticultural product line that includes baskets, flower pots and trays. Some of these products are manufactured under a contract for another company.

Another major product line is plastic adjusting rings of different sizes. Like some of the horticultural products, this product line is manufactured under contract for Ladtech, Inc., another startup company. It

holds significant market potential as a replacement for concrete adjusting rings made with virgin materials. The adjusting rings are made of 100 percent recycled plastics and has significant performance advantages.

### **Manufacturing Capacity**

Monarch's overall recycled material capacity will exceed 5,000,000 lbs/year. Currently, it can use in its manufactured products over 3,000,000 pounds per year of high density polyethylene (HDPE) and 1,500,000 pounds per year of polypropylene (PP). In its first year the company used 500,000 - 1,000,000 pounds HDPE and 750,000 pounds PP.

Since its startup, Monarch has manufactured over 2,000,000 horticultural units and 40,000 adjusting ring units.

### **Employment Information**

Currently, the company has 25 employees. Monarch's manufacturing jobs include 9 skilled and 15 non-skilled. Employment may increase as contracted manufactured product sales increase.

### **Economic Information**

Gross sales for FY 1997, ending June 30, 1997, are estimated at \$900,000. The company expects significant growth in its adjusting ring product and its pool step product.

Currently, the company's total capital investment in buildings and equipment is \$750,000. Additional capital investment is projected.

### **Environmental Impacts**

The products manufactured by Monarch can use a wide specification plastic, which diverts more plastic from landfills and incineration.

### **Additional Information**

The company provides a local recycled plastics market in this small rural community of Little Falls. City financing partners support the company since it creates local jobs and provides a local market for recycled plastics. Increased recyclables collection has occurred in the region because of this market.