MEASURING THE ECONOMIC IMPACT OF CIRCULAR MATERIAL FLOW IN NORTHWEST ARKANSAS

Produced for The Sustainability Consortium

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Executive Summary

Improving the circulation of recyclable and reusable materials in Northwest Arkansas presents an opportunity to generate significant economic activity in the region and reduce the region's negative environmental impact. Northwest Arkansas recovered almost 34,200 US tons of recyclable materials in Fiscal Year 2019 (July 1, 2018 to June 30, 2019) at a 51.2 percent capture rate (the percentage of available material that is recovered at collection)[i] by total weight. The Center for the Business and Economic Research estimated the current economic impact of scrap materials in Northwest Arkansas. In addition, the researchers investigated the potential economic impact from improving the circular flow of scrap materials in Northwest Arkansas in three scenarios: a scenario with recycling facilities in Northwest Arkansas which uses all of Northwest Arkansas' current collected scrap materials, a scenario with recycling facilities in Northwest Arkansas where 65.0 percent of the material is recycled and circulated in Northwest Arkansas, and a scenario with recycling facilities in Northwest Arkansas where 75.0 percent of material is recycled and circulated in Northwest Arkansas. The latter two scenarios are based on recycling targets enacted by the legislatures of California[ii] and Florida[iii], along with initiatives in Missouri.[iv] The potential impacts figures are generated under the assumption that scrap materials are both recycled and reused solely by industries located in Northwest Arkansas, therefore these estimates represent the highest estimate of potential economic impacts. The assumption is contingent on the establishment of facilities in Northwest Arkansas for the feasible materials of glass, cardboard, and the plastic Polyethylene Terephthalate (PET).

- Northwest Arkansas' current recycling situation, a 51.2 percent capture rate based on total weight, is estimated to have had a regional economic impact of almost $33.7 million and more than $2.3 million in local and state tax revenue in Fiscal Year 2019. The economic activity is associated with supporting almost 184 jobs in Northwest Arkansas with annual labor income of $10.1 million.
- The three scenarios presented below and their estimates are contingent on Northwest Arkansas establishing recycling manufacturers for the economically feasible materials of glass, cardboard, and the plastic PET to turn them into usable inputs which will be utilized by industries in Northwest Arkansas.
- Scenario 1 is defined by the establishment of specific recycling facilities in Northwest Arkansas combined with Northwest Arkansas' current recycling situation, a 51.2 percent capture rate based on total weight. The conditions of Scenario 1 during Fiscal Year 2019 could have generated a regional economic impact estimated to be greater than $49.9 million (more than $16.2 million in new economic activity) with over $2.7 million in local and state tax. The economic activity is estimated to support 240 jobs (over 56 new jobs) with labor income of almost $13.6 million.
- Scenario 2 is defined by Northwest Arkansas achieving a 65.0 percent capture rate and the establishment of specific recycling facilities. The conditions of Scenario 2 during Fiscal Year 2019 could have generated a regional economic impact estimated to be greater than $63.4 million (almost $29.8 million in new economic activity) with almost $3.5 million in local and state tax revenue. The economic activity could have supported almost 305 jobs (over 121 new jobs) with labor income of more than $17.2 million.

- Scenario 3 is defined by Northwest Arkansas achieving a 75.0 percent capture rate and the establishment of specific recycling facilities. The conditions of Scenario 3 during Fiscal Year 2019 could have generated a potential regional economic impact estimated to be greater than $73.3 million (over $39.6 million in new economic activity) and $4.0 million in local and state tax revenue in Fiscal Year 2019. The economic activity could have supported almost 305 jobs (almost 169 new jobs) with labor income of almost $19.9 million.

Markets for Recovered Materials

- The demand for recycled plastic is dependent on oil price and is focused on materials used for production of containers for consumer goods. A smaller PET plastic recycling facility may be sustainable in Northwest Arkansas if materials can be sourced from across Arkansas and possibly nearby areas in Oklahoma and Missouri.
- The U.S. recycled metal market has an overabundance of scrap metal and exports a significant amount of scrap metal. China, the top purchaser of U.S. scrap metal, has shifted its policy away from importing scrap metal. The policy change presents opportunities for scrap metal facilities, although a facility in Northwest Arkansas has limited feasibility due to the investment costs, limited regional supply, and uncertain regional demand for recycled metals.
- The U.S. exports a large portion of its recycled paper and there is a high demand for recycled corrugated fiber. A facility for recycling corrugated box fiber could be feasible in Northwest Arkansas but would require recovery of a substantial amount of material across Arkansas, and potentially nearby regions in Oklahoma and Missouri.
- The demand for recycled glass is driven by its value in sustainability marketing and substantial energy cost savings. The cost of recycled glass is greater than the raw materials for glass manufacturing. An opportunity for a facility in Northwest Arkansas is possible but would require transport of recovered glass across Arkansas, and possibly nearby regions in Oklahoma and Missouri, to the region and a significant capital investment.

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Introduction

The Sustainability Consortium requested that researchers from the Center for Business and Economic Research conduct a study that qualitatively and quantitatively analyzes the potential impacts of improving the circular flow of scrap materials in Northwest Arkansas. This study provides a detailed analysis of various recycling scenarios, based on different capture rates (the percentage of available material that is recovered at collection)[v], and the potential impact on the regional economy, defined as Benton, Madison, and Washington counties. In addition, the study reviews the markets for different recycled materials to examine the feasibility of local industries participating in the circular flow of scrap materials.

For this report, data was collected from local municipalities and counties and researchers from the Center provided reasonable estimates where the collected data alone was not sufficient to estimate the potential impacts of improving the circular flow of scrap materials. The following report estimates that Northwest Arkansas' current recycling activity, collecting and sorting of materials, had an economic impact of $33.7 million in 2019. The establishment of facilities in Northwest Arkansas, for the feasible materials of glass, cardboard, and the plastic Polyethylene Terephthalate (PET), is estimated to have had a potential economic impact in Northwest Arkansas of more than $49.9 million in 2019 under the current 51.2 percent recycling capture rates, assuming all the recycled materials where utilized by regional industries. The figure represents an increase of more than $16.2 million in economic impact in Northwest Arkansas.

The potential impact increases to more than $63.4 million at a 65.0 percent overall capture rate and to $73.3 million at a 75.0 percent overall capture rate. These estimates represent the high end of the economic impacts since it is assumed that the recycled materials are fully used in regional industries and are not exported out of the region. Insufficient material sourcing and uncertain markets for recycled products would mean that these impacts may not be fully realized in Northwest Arkansas without significant improvements in collection rates and importing recycled materials from several surrounding regions.

Methodology

The estimates in this report are generated based on methodology presented by a 2016 Environmental Protection Agency (EPA) report and the IMPLAN model. The EPA's 2016 Recycling Economic Information (REI) report provides models to estimate jobs, wages and taxes based on the amount of recovered materials from nine material categories. The 2016 REI report's methodology is utilized to estimate job figures associated with recycling activity within specific industry classifications. The job figures are allocated to sectors within the IMPLAN input/output model to calculate the overall economic impact in Northwest Arkansas, defined as Benton, Madison, and Washington counties. The impact estimates are on the high end as it is assumed that all recovered materials are both recycled and reused by industries located in Northwest Arkansas.

The 2016 REI report presents a waste input-output (WIO) model for the U.S. The model is built using the Bureau of Economic Analysis' U.S. input-output tables which detail interactions between industries in the U.S. THE WIO model allows for recyclable and recycled material flows to be disaggregated from the national input-output table and links the flows of recycling inputs and outputs within the economy. The recycling activity is based on the amount of materials collected and transformed into new products. The WIO model accounts for the material categories of (1) ferrous metals; (2) aluminum; (3) rubber; (4) plastics; (5) glass; (6) paper; (7) construction and demolition (C&D) material; (8) electronics; and (9) food and organics.[vi] The definitions for these categories are available in the appendix.

The WIO model estimates job, wage and tax data based on the amount of materials recycled. The model utilizes data on jobs and wages collected from publicly available information sources, including the Census Bureau Statistics on U.S. Businesses (SUSB), the U.S. Agricultural Census, and the U.S. Census of Governments. Data regarding corporate tax review were collected from the Internal Revenue Service (IRS) Statistics of Income (SOI) program.[vii]

Job estimates in the 2016 REI report are provided separately for primary and secondary recycling activities. The primary recycling jobs are involved in the actual transformation of recyclable material into marketable product. An example is the transformation of iron scrap into semi-fabricated products (e.g. ingots) in a smelter. The secondary recycling jobs are involved with the collection, sorting and transportation of recyclable materials to firms who will turn the material into marketable products.

The 2016 REI report also provides an estimation method for state and local recycling activity. The estimation method provides coefficients for employment, wages and tax revenue based on the amount of a material collected. In this report, employment estimates are generated based on the recovered recyclable materials data reported by the municipalities in Northwest Arkansas. In addition, three hypothetical scenarios are presented where recycling facilities for glass, cardboard, and the plastic PET have been established in Northwest Arkansas. The first hypothetical scenario is based on the current recycling volume in Northwest Arkansas. The latter two hypothetical scenarios are presented based on Northwest Arkansas achieving specific recycling capture rates.

The job estimates generated by the model in the REI report are utilized by the IMPLAN model to reconcile them with local data in order to generate total economic impacts. The IMPLAN model generates wage and compensation, employment numbers, tax revenue and aggregate economic impact of collection and reuse of scrap materials in Northwest Arkansas.

An IMPLAN model produces direct, indirect, and induced estimate impacts. The direct impacts capture the employment and purchase of goods and services by firms in the region who realize the activity being evaluated. In this report, the activity is the collection and reuse of scrap materials. The indirect impacts capture the goods and services purchased by the firms who supply the firms who are directly involved with the activity of evaluation; ex. utility companies, office supply retailers, etc. The induced impacts capture the increased household spending in the region by the employees of firms in the direct and indirect impact streams. The three impacts are added together to generate the total impact. A detailed description of the IMPLAN model can be found in Appendix A. The IMPLAN impacts for this report are high-end estimates as the main assumption is all recovered materials are recycled and made into new products without leaving Northwest Arkansas.

Recycling in Northwest Arkansas

The Northwest Arkansas' recycling data was collected by The Sustainability Consortium. The data comes from survey forms, required by the Arkansas government, for Fiscal Year 2019 (July 1, 2018 – June 30, 2019) and covers the municipalities of Benton, Madison, and Washington counties. Currently, Northwest Arkansas sends its recyclables mostly to domestic buyers. Paper goes to firms in nearby states while residential plastic is sent to the Southeast.[viii]

The recycled materials were reported by category (plastics, metals, glass, etc.) and subcategory (aluminum, copper, cardboard, etc.). The capture rates for Northwest Arkansas were unavailable so residential statistics from a 2020 nationwide report by the Recycling Partnership were used for this report. However, the report does not have residential capture rates for all materials recovered in the region and for those materials the average capture rate was used. The Recycling Partnership rates are for single-stream curbside recycling programs, so not an ideal match for the data reported in Arkansas, which includes drop-off programs. As drop-off sites are assumed to have lower capture rates than single-stream curbside collection, the estimates below may underrepresent the amount of material potentially available but not currently recycled in the region.[ix]

Table 1: Summary of Recovered Materials in Northwest Arkansas

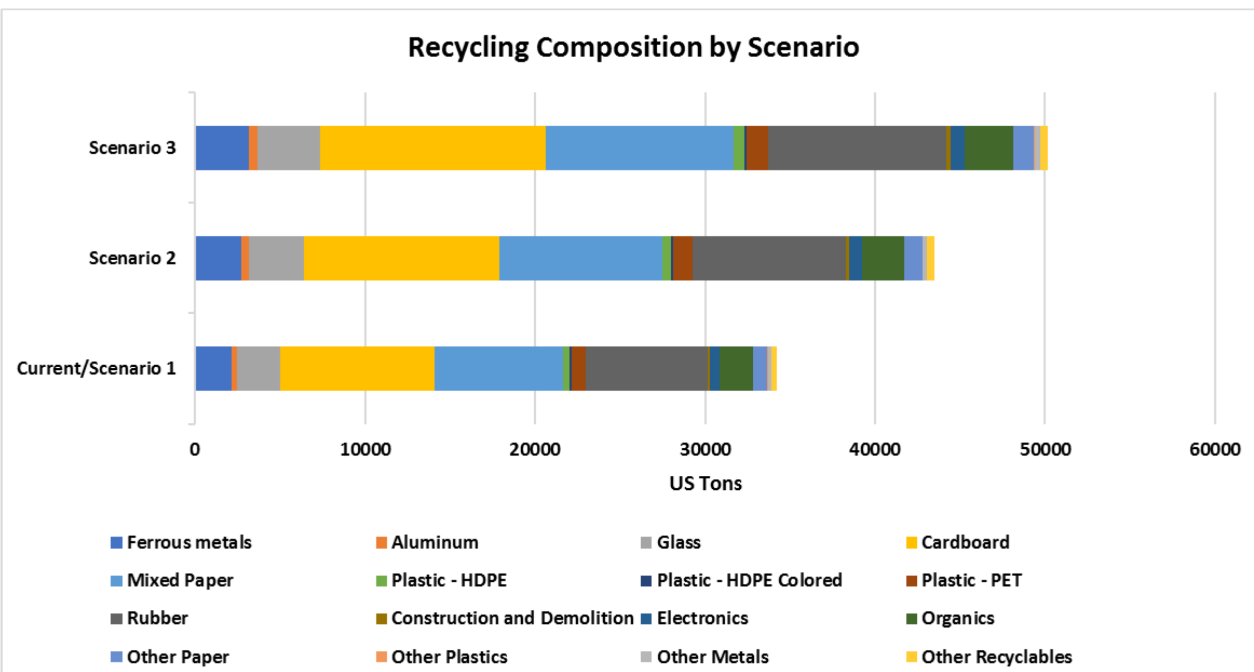
Summary of Recovered Materials						
	Current/Scenario 1		Scenario 2		Scenario 3	
Material	**US tons**	**Capture Rate[x]**	**US tons**	**Capture Rate**	**US tons**	**Capture Rate**
Ferrous metals	2,147.2	37.0%	2,728.9	47.0%	3,148.8	54.3%
Aluminum	342.4	38.0%	435.2	48.3%	502.1	55.7%
Glass	2,539.3	62.0%	3,227.3	78.8%	3,723.8	90.9%
Cardboard	9,038.4	62.0%	11,487.1	78.8%	13,254.3	90.9%
Mixed Paper	7,553.2	46.0%	9,599.5	58.5%	11,076.3	67.5%
Plastic - HDPE	394.1	53.0%	500.9	67.4%	577.9	77.7%
Plastic - HDPE Colored	120.0	46.0%	152.5	58.5%	176.0	67.5%
Plastic – PET	875.0	40.0%	1,112.1	50.8%	1,283.2	58.7%
Rubber	7,115.4		9,043.1		10,434.4	
Construction and Demolition	169.9		215.9		249.2	
Electronics	577.2		733.6		846.4	
Organics	1,951.0		2,479.6		2,861.0	
Other Paper	823.7		1,046.9		1,208.0	
Other Plastics	41.0		52.1		60.2	
Other Metals	205.9		261.7		301.9	
Other Recyclables	306.0		388.9		448.8	
Total	34,199.7	51.2%	43,465.2	65.0%	50,152.2	75.0%

Northwest Arkansas recycled almost 34,200 US tons of materials in Fiscal Year 2019. Among the materials with capture rates, there was a 51.2 percent capture rate when averaged by volume and this is used as the baseline scenario in this report. All materials without explicit capture rates have the 51.2 percent rate used as their corresponding capture rate for analysis. In addition, our analysis examines two alternative scenarios where Northwest Arkansas improved processes to achieve higher capture rates of 65.0 percent and 75.0 percent of all scrap materials.

The two capture rate targets are based on the enact policy and initiatives of other states. The states of California and Florida have enacted policy in 2011[xi] and 2008[xii] to achieve a recycling goal of 75.0 percent by 2020. Florida's legislation outline interim recycling goals of 40.0 percent by 2012, 50.0 percent by 2014, 60.0 percent by 2016 and 70.0 percent by 2018.[xiii] In the neighboring state of Missouri, the Missouri Recycling Association (MORA) is leading a grassroots campaign to update the state's legislated capture rate target from 40.0 percent, enacted in 1990, to 75.0 percent.[xiv]

In both scenarios, the capture rate for each material is generated based on the proportional weight in the baseline scenario for recycling in Northwest Arkansas. The proportional weights are applied to the total volume of recycled material for a scenario and the material volumes generated are compared to the volumes from the baseline scenario which allows the relevant capture rates to be calculated for each material. Materials without available capture rate data are assumed to be recycled at the average capture rate of their scenario (51.2, 65.0 or 75.0 percent). Table 1 provides the breakdown of material volumes by type of material and scenario.

Figure 1: Recycling Composition by Scenario



The volume of materials for each of the scenarios listed in Table 1 was used to generate job estimates for Northwest Arkansas from the REI report's coefficients for jobs. The job coefficient values, presented in Table 2, are the estimates of jobs created based on the volume of a recycled material. The job coefficients are separated into primary recycling jobs and secondary recycling jobs. The primary jobs involve the conversion of recycled materials into new products and are in manufacturing activities; ex. metal workers who turn scrap metal into new ingots. The secondary jobs involve the collection, sorting, and distribution of recycled materials so the industries are more service related; ex. sorters at a material recovery facility and wholesale agents who sell the recovered materials.

Table 2: Jobs Per US Ton by Material

Jobs Per US Ton by Material			
Material	**Primary Jobs /US Ton**	**Secondary Jobs /US Ton**	**Total Jobs / US Ton**
Ferrous	0.00216	0.00238	0.00454
Aluminum	0.02904	0.04553	0.07457
Glass	0.00402	0.00542	0.00943
Paper	0.00052	0.00103	0.00154
Plastics	0.01192	0.01484	0.02676
Rubber	0.00481	0.00209	0.00689
Construction and Demolition	0.00034	0.00032	0.00066
Electronics	0.01874	0.01383	0.03257
Organics	0.00073	0.00018	0.00091
Average	0.00077	0.0008	0.00157

The material volumes presented in Table 1 and job coefficients from Table 2 are used to generate the job estimates from these activities in Northwest Arkansas (Table 3). The job estimates assume that the materials recovered in Northwest Arkansas are entirely recycled and processed into new products within the region. The recovered materials for PET plastic, cardboard (paper) and glass will generate primary job estimates due to the feasibility of their recycling facilities. The secondary jobs include employment associated with residential curbside collection, materials recovery facilities, and recyclable material wholesalers which are the largest individual job sectors from the estimates. The recycling-related jobs figures are used in IMPLAN regional models to estimate total impacts for jobs, wages and compensation, local and state taxes, and overall economic impact.

Table 3: Recycling-Related Job Estimates by Recycling Scenario

Recycling-Related Job Estimates by Recycling Scenario				
	Current	**Scenario 1**	**Scenario 2**	**Scenario 3**
Primary Jobs	0	25.3	32.2	37.2
Secondary Jobs	97.3	97.3	123.6	142.7
Total	97.3	122.6	155.8	179.9

Markets for Recovered Materials

The sustainability of the circular flow of scrap materials through the regional economy requires sufficient supply and demand for those materials. A 2017 report by the Seidman Research Institute, on behalf of the Walton Sustainability Solutions Initiatives (Arizona State University) and the city of Phoenix, provides an excellent summary of the recycling markets for plastic, metal, paper, and glass. A brief discussion of the findings and its applicability to the Northwest Arkansas scrap materials market is presented in this section.

Plastic

The Society of the Plastic Industry (SPI) has seven classifications for plastic, but most of the demand in recycled plastic market is for SPI Code 1: Polyethylene Terephthalate (PET) and SPI Code 2: High Density Polyethylene (HDPE). PET is used for bottling water and soft drinks, among other uses while HDPE is used for plastic grocery bags, water and juice containers, and detergent and shampoo bottles.[xv]

The production of recycled plastic requires the removal of contaminants which increases production costs. Additionally, the use of recycled plastic may need to compensate for surface defects by using a toughening agent or additional pigment which also adds to costs.[xvi] The recycling market for plastic also operates within the context of global oil prices, where in general, low oil prices make new, virgin plastic cheaper to use than recycled plastic. Most plastic recyclers in the U.S. operate on a small scale and during periods of low oil prices, plastic recyclers can often be forced out of business.

The Seidman report notes an Oregon facility which recycles over 7,500 US tons of PET annually. A similar facility in Phoenix if operational for five consecutive years could generate $113.5 million in cumulative economic activity and could support 50 jobs with a cumulative real disposable personal income of $57.2 million. Each job could support up to 3.1 job years (full employment for one person for one year) of additional employment in the county. The total capital expenditure, buildings and equipment, would be at least $10 million.[xvii] A similar facility in Northwest Arkansas appears unfeasible as the region only collected 875 US tons of PET at a 40 percent capture rate in Fiscal Year 2019. A smaller PET facility that processes about a third of the volume of the Oregon facility (2,500 US tons) could potentially be sustained from increasing the recovery rate of PET in Northwest Arkansas and redirecting the PET collected in the rest of Arkansas. A hypothetical 50.8 percent capture rate in Northwest Arkansas would generate about 1,282 US tons of PET annually. The remainder of materials could be sourced from recovered PET across the state as Arkansas (including Northwest Arkansas) recycled 2,262 US tons of PET in Fiscal Year 2017.[xviii] The neighboring regions in Oklahoma[xix] and Missouri[xx] may be viable sources for recyclable PET.

Metal

The global metal logistics chain is comprised of scrap metal brokers, merchants or dealers, and large scale metal shredders. The brokers acquire scrap from residents and small firms while dealers receive their scrap from cities, manufacturers and other large agents. Brokers are small operations and sell to shredders who then sell to manufacturers who turn the material into ingots.[xxi]

The U.S. exports a large amount of scrap metal and China is the largest purchaser. In 2016, the U.S. recycled 3,946,274 US tons of aluminum and 924,839 US tons of copper[xxii] while the scrap alloy exports for these materials were 1,492,225 and 1,040,088 US tons, respectively.[xxiii] China accounted for 70 percent of copper scrap exports and 51 percent of aluminum scrap exports in 2016.[xxiv] In recent years China has moved to restrict and ban the import of scrap materials. In 2019, China began restricting imports of specific ferrous and non-ferrous metallic scrap with quotas and in 2020 will impose bans on stainless steel scrap.[xxv] The change in policy has led some manufacturers to invest in secondary smelters[xxvi] which suggests opportunities exist for domestic smelters using scrap metals. However, the U.S. has currently responded by spending low-grade scrap to Malaysia where it is cleaned and processed to then be sent to China.[xxvii]

The feasibility of recycling-related metal smelters appears limited in Northwest Arkansas. The Seidman report highlights how greater scrap metal processing in Arizona would require a stronger manufacturing base to justify the increase in available supply. Notably, the local Aloca Inc. aluminum facility is unable to consume all the scrap aluminum produced in Phoenix.[xxviii] Northwest Arkansas has a strong manufacturing base, but it seems unlikely that they would generate enough demand to sustain the appropriate facilities, such as smelters. This fact is stressed by the capital demands for such facilities. For example, a new aluminum greenfield smelter would require three years to construct and cost $1 billion.[xxix] The current amount of recovered metals in the region does not appear to justify such investment.

Paper

The U.S. is currently a net exporter of recycled paper as there are insufficient mills in the nation to repurpose the recycled paper. Paper can be recycled up to seven times before it cannot be reused. A high demand exists for recycled corrugated fiber and is driven by companies like Amazon and Walmart.[xxx]

A recycling mill would require at least 1,000,000 US tons of recycled paper to operate annually.[xxxi] Across all fiber types, Northwest Arkansas only collected 17,589 US tons of paper in Fiscal Year 2017 and as of Fiscal Year 2017 Arkansas only collected 196,103 US tons of paper across all types.[xxxii] Given the limited nature of available materials within Arkansas, a recycling mill does not appear feasible.

The Seidman report noted an opportunity in Phoenix for corrugated box fiber recycling. Assuming a supply of 156,000 US tons of corrugated box fiber, a hypothetical facility operating for 5 consecutive years would generate $437.4 million in cumulative economic output that supports 140 jobs and an associated $219.2 million in cumulative disposable personal income. Each job could generate 4.4 additional jobs years (full employment for one person for one year) of employment in the immediate county.[xxxiii] An opportunity for a facility in Northwest Arkansas exists, as the state of Arkansas as a whole collected 155,803 US tons of recyclable cardboards in Fiscal Year 2017[xxxiv] but it would require the recovery and transport of this material from across the state to Northwest Arkansas. Additional material could be sourced from nearby municipalities in Oklahoma[xxxv] and Missouri.[xxxvi]

Glass

The market for recycled glass is influenced by cheap, virgin raw materials for glass and the capital-intensive nature of recycled glass production. Glass has a low price and the raw materials for glass manufacturing, like sand, are often cheaper than recycled glass cullet. The appeal of recycled glass is its sustainability marketing value and substantial energy cost savings.[xxxvii]

The Glass Packaging Institute estimates that energy costs drop about 2.0-3.0 percent for every 10.0 percent of cullet used in the manufacturing process. Recycled glass (cullet) can constitute up to 95.0 percent of the raw materials used in the manufacture of glass products. Items such as glass bottles and jars are potentially 100.0 percent perpetually recyclable.[xxxviii]

Glass recycling requires substantial capital in its production. Recovered materials must be screened, crushed and then sorted by type (flint, emerald, and amber) which require different machines. The quality of recycled glass is important as glass free of impurities fetches a higher price from purchasers and reduces their costs. A glass only stream from municipalities, such as that in Fayetteville, would decrease the propensity of impurities and increase both the value of and the capture rate for recyclable glass during production.[xxxix]

The city of Phoenix examined adding 4,591 US tons of recycled glass to their current annual capacity of 50,000 US tons. The addition material would require $1.5 million in new equipment while employing an additional 5 people. Over a six-year operational period, the investment could generate $11.4 million in cumulative economic activity, $5.8 million in cumulative real disposable personal income, and each jobs could create 3.0 additional job years of employment elsewhere in Maricopa County.[xl] The 2,569 US tons of glass currently recovered in Northwest Arkansas, at a 62.0 percent capture rate, alone would not warrant a facility in the region. A feasible facility would require raising the capture rate for glass, a 78.7 percent capture rate would recover about 3,262 US tons of glass annually, and sourcing recovered material from across the state as Arkansas recycled 21,156 US tons of glass (including Northwest Arkansas) in Fiscal Year 2017.[xli] The nearby regions in Oklahoma[xlii] and Missouri[xliii] could serve as additional sources of materials.

Impacts

The Northwest Arkansas impact figures are high-end estimates as it is based on the assumption that recovered materials are both recycled and reused by industry entirely in Northwest Arkansas. The impacts for the latter three scenarios in this section assume that recycling facilities have been established for the economically feasible materials of glass, cardboard, and the plastic PET. The jobs associated with the collection and reuse of scrap materials can generate additional economic impacts within the Northwest Arkansas region through indirect and induced impacts. The aggregate impacts for employment, labor income and economic output along with tax revenue are displayed in Figures 2 and 3 on page 18.

In 2019, the collection and sorting of scrap materials within Northwest Arkansas was estimated to have generated an economic impact of almost $33.7 million. For the region, the output multiplier for economic activities associated with the collection and reuse of scrap materials was 1.55. This means for every dollar of direct activity from the collection and reuse of scrap materials, the total economic impact generated within the region was $1.55. These activities are estimated to have directly supported over 97 recycling-related collection and processing jobs in Northwest Arkansas and a total of almost 184 jobs through indirect and induced effects. Total labor income generated in Arkansas by the annual business expenditures was $10.1 million in 2019.

Table 4: Northwest Arkansas' Current Recycling Scenario Economic Impact

Current Recycling Scenario's Economic Impact in Northwest Arkansas				
Impact Type	Employment	Labor Income	Total Value Added	Output
Direct Effect	97.3	$6,124,148	$11,490,705	$21,751,142
Indirect Effect	52.6	$2,633,942	$4,322,476	$7,742,489
Induced Effect	33.6	$1,351,429	$2,445,530	$4,195,175
Total Effect	183.5	$10,109,518	$18,258,711	$33,688,806

These business activities of the collection and reuse of scrap materials and their associated impacts contributed significant tax collections that accrued to both the state of Arkansas and the various local governments in the areas of operation. According to estimates from the IMPLAN software, the direct business activities of the collection and reuse of scrap materials combined with indirect and induced effects generated over $2.3 million in total taxes to state and local governments.

Table 5: Estimated State & Local Taxes Generated by Northwest Arkansas' Current Recycling Scenario

Estimated State and Local Taxes Generated by Current Recycling Scenario					
Tax Type	Employee Compensation	Tax on Production and Imports	Households	Corporations	Total Taxes Generated
Total Effect	$2,423	$2,069,269	$236,262	$28,619	$2,336,573

Scenario 1 is defined as the establishment of recycling facilities for the economically feasible materials of glass, cardboard, and the plastic PET in Northwest Arkansas and assumes current collections are utilized by recycling industries. Scenario 1 could have generated an economic impact of almost $50 million in Fiscal Year 2019, an increase in economic activity of over $16.2 million from the current situation in Northwest Arkansas. For the region, the output multiplier for economic activities associated with Scenario 1 would have been 1.52. This means for every dollar of direct activity from the collection, sorting, recycling and reuse of scrap materials, the total economic impact generated within the region would have been $1.52. The activities of Scenario 1 could directly support almost 123 recycling-related jobs (over 25 jobs created) in Northwest Arkansas and a total of 240 jobs through indirect and induced effects (over 56 total jobs created). Total labor income generated in Arkansas by the annual business expenditures could have been nearly $13.6 million in 2019.

Table 6: Northwest Arkansas' Scenario 1 Recycling Economic Impact

Recycling Scenario 1's Economic Impact in Northwest Arkansas				
Impact Type	Employment	Labor Income	Total Value Added	Output
Direct Effect	122.6	$7,856,546	$15,166,475	$32,868,409
Indirect Effect	72.3	$3,882,478	$6,358,257	$11,446,429
Induced Effect	45.1	$1,814,355	$3,283,202	$5,632,211
Total Effect	240.0	$13,553,379	$24,807,933	$49,947,048

These business activities of Scenario 1 and their associated impacts could contribute significant tax collections that accrued to both the state of Arkansas and the various local governments in the areas of operation. According to estimates from the IMPLAN software, the direct business activities of Scenario 1 combined with indirect and induced effects could have generated over $2.7 million in total taxes to state and local governments, an increase of $394,815 from the current estimate.

Table 7: Estimated State & Local Taxes Generated by Northwest Arkansas' Scenario 1 Recycling

Estimated State and Local Taxes Generated by Recycling Scenario 1					
Tax Type	Employee Compensation	Tax on Production and Imports	Households	Corporations	Total Taxes Generated
Total Effect	$3,260	$2,369,313	$316,652	$42,163	$2,731,388

Scenario 2 assumes a 65.0 percent capture rate of scrap materials and the reuse of all those materials within Northwest Arkansas, aided by the establishment of recycling facilities for the economically feasible materials of glass, cardboard, and the plastic PET in Northwest Arkansas. In 2019, Scenario 2 could have generated an economic impact of more than $63.4 million in Northwest Arkansas, an increase in economic activity of almost $29.8 million from the current estimate. These activities could directly support almost 156 recycling-related jobs (almost 59 jobs created) in Northwest Arkansas and a total of almost 305 jobs (over 121 total jobs created) through indirect and induced effects. Total labor income generated in Arkansas by the annual business expenditures would be greater than $17.2 million in 2019.

Table 8: Northwest Arkansas' Scenario 2 Recycling Economic Impact

Recycling Scenario 2's Economic Impact in Northwest Arkansas				
Impact Type	Employment	Labor Income	Total Value Added	Output
Direct Effect	155.8	$9,980,936	$19,260,944	$41,752,203
Indirect Effect	91.8	$4,932,380	$8,077,505	$14,542,067
Induced Effect	57.3	$2,304,947	$4,170,961	$7,155,129
Total Effect	304.9	$17,218,263	$31,509,410	$63,449,398

These business activities of Scenario 2 and their associated impacts contributed significant tax collections that accrued to both the state of Arkansas and the various local governments in the areas of operation. According to estimates from the IMPLAN software, the direct business activities of Scenario 2 combined with indirect and induced effects could generate nearly $3.5 million in total taxes to state and local governments, an increase of over $1.1 million from the current estimate.

Table 9: Estimated State & Local Taxes Generated by Northwest Arkansas' Scenario 2 Recycling

Estimated State and Local Taxes Generated by Recycling Scenario 2					
Tax Type	Employee Compensation	Tax on Production and Imports	Households	Corporations	Total Taxes Generated
Total Effect	$4,141	$3,008,813	$402,275	$53,538	$3,468,767

Scenario 3 assumes a 75.0 percent capture rate of scrap materials and the reuse of all those materials within Northwest Arkansas, aided by the establishment of recycling facilities for the economically feasible materials of glass, cardboard, and the plastic PET in Northwest Arkansas. In 2019, Scenario 3 could have generated an economic impact of $73.3 million in Northwest Arkansas, an increase in economic activity of almost $39.6 million from the current estimate. These activities could directly support almost 180 recycling-related jobs (almost 83 jobs created) in Northwest Arkansas and a total of 352 jobs (almost 169 total jobs created) through indirect and induced effects. Total labor income generated in Arkansas by the annual business expenditures would be nearly $19.9 million in 2019.

Table 10: Northwest Arkansas' Scenario 3 Recycling Economic Impact

Recycling Scenario 3's Economic Impact in Northwest Arkansas				
Impact Type	Employment	Labor Income	Total Value Added	Output
Direct Effect	179.9	$11,526,532	$22,250,408	$48,239,483
Indirect Effect	106.0	$5,698,444	$9,332,182	$16,800,643
Induced Effect	66.2	$2,662,256	$4,817,538	$8,264,308
Total Effect	352.2	$19,887,232	$36,400,128	$73,304,434

These business activities of Scenario 3 and their associated impacts contributed significant tax collections that accrued to both the state of Arkansas and the various local governments in the areas of operation. According to estimates from the IMPLAN software, the direct business activities of Scenario 3 combined with indirect and induced effects could generate $4.0 million in total taxes to state and local governments, an increase of almost $1.7 million from the current estimate.

Table 11: Estimated State & Local Taxes Generated by Northwest Arkansas' Scenario 3 Recycling

Estimated State and Local Taxes Generated by Recycling Scenario 3					
Tax Type	Employee Compensation	Tax on Production and Imports	Households	Corporations	Total Taxes Generated
Total Effect	$4,783	$3,475,005	$464,631	$61,870	$4,006,289

Figure 2: Total Economic Impacts by Recycling Scenario

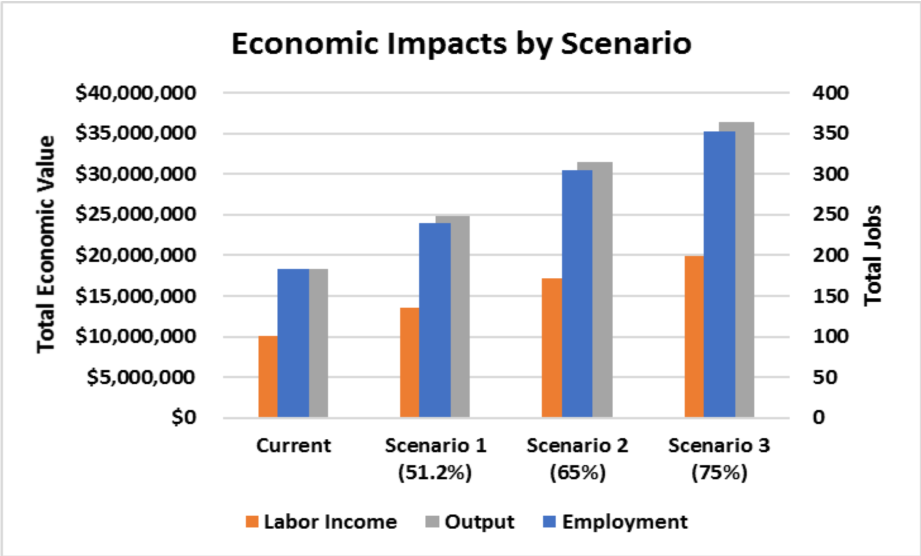
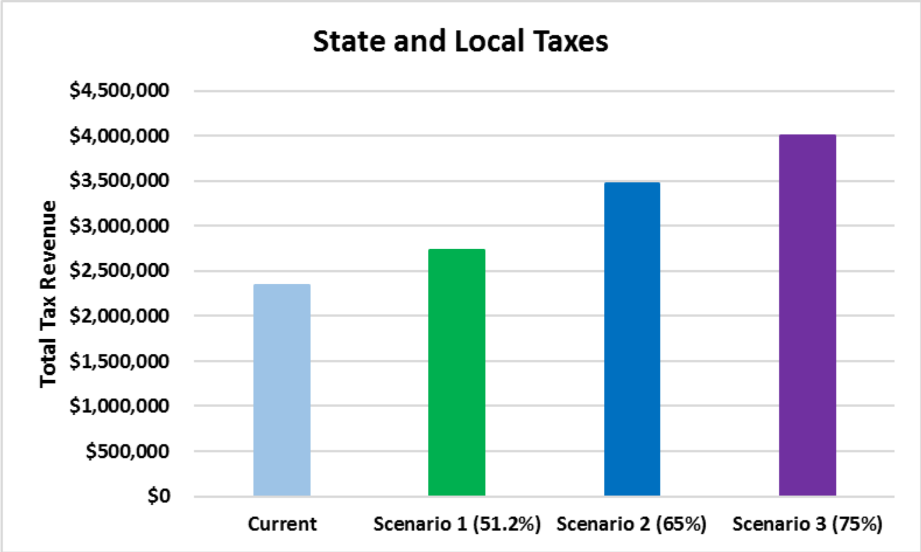


Figure 3: Total State and Local Tax Revenue by Recycling Scenario



Conclusion

The collection and reuse of scrap materials in Northwest Arkansas has the potential to generate numerous jobs, significant tax revenue and a sizeable economic impact. The current recycling data for Northwest Arkansas is estimated to generate almost $33.7 million of economic activity with about 184 jobs, over $10.1 million in labor income, and more than $2.3 million in local and state taxes.

The figures could be larger if recycling facilities for the economically viable recyclable materials of glass, cardboard, and the plastic Polyethylene Terephthalate (PET) were constructed in Northwest Arkansas. The attainment of even greater impacts could be realized if the overall recycling capture rate could increase to 65.0 or 75.0 percent, as displayed in Table 10 and 11. The estimates are contingent on recycling recovered materials and producing new materials entirely in Northwest Arkansas. The realization of the estimates would require investment in equipment and facilities to turn recovered materials into products for industry.

The actions required to embrace the potential of the collection and reuse of scrap materials in Northwest Arkansas are not seamless. The feasibility of regional recycling facilities is dependent on the demand and supply of recycled materials in the region and nearby markets. Northwest Arkansas alone does not produce enough recovered materials to sustain recycling facilities and would require sourcing materials from other regions of the state. A scrap metal facility would require a significant capital investment but has limited regional supply of material and uncertain demand for its outputs. The recycled paper, glass, and plastic sectors show potential for facilities based on specific subcategories within their markets, although they would require sourcing of materials from outside the region and significant capital investments. The uncertainties within each sector hampers the return on investments in these facilities and the realization of a vibrant economy based on the circular flow of scrap materials in Northwest Arkansas.

Table 12: Total Economic Impact in Northwest Arkansas by Recycling Scenario

Total Economic Impact by Recycling Scenario in Northwest Arkansas				
Recycling Scenario	Employment	Labor Income	Total Value Added	Output
Current	183.5	$10,109,518	$18,258,711	$33,688,806
Scenario 1 (51.2%)	240.0	$13,553,379	$24,807,934	$49,947,048
Scenario 2 (65%)	304.9	$17,218,263	$31,509,410	$63,449,398
Scenario 3 (75%)	352.2	$19,887,232	$36,400,128	$73,304,434

Table 13: Total Estimated State and Local Taxes Generated by Recycling Scenario

Total Estimated State and Local Taxes Generated by Recycling Scenario					
Recycling Scenario	Employee Compensation	Tax on Production and Imports	Households	Corporations	Total Taxes Generated
Current	$2,423	$2,069,269	$236,262	$28,619	$2,336,573
Scenario 1 (51.2%)	$3,260	$2,369,313	$316,652	$42,163	$2,731,388
Scenario 2 (65%)	$4,141	$3,008,813	$402,275	$53,538	$3,468,767
Scenario 3 (75%)	$4,783	$3,475,005	$464,631	$61,870	$4,006,289

Figure 4: Total Economic Impact by Recycling Scenario

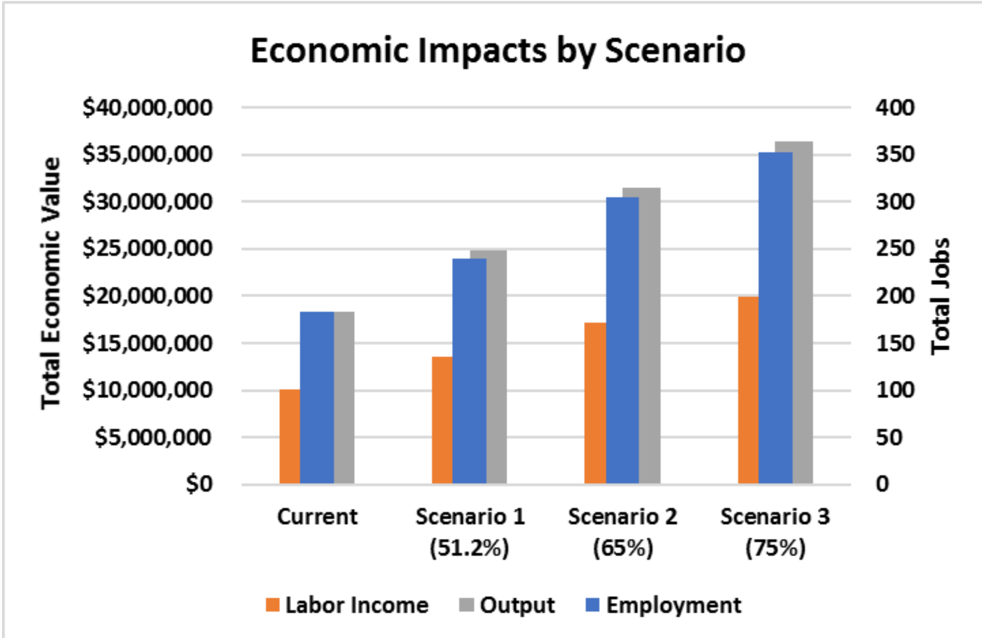
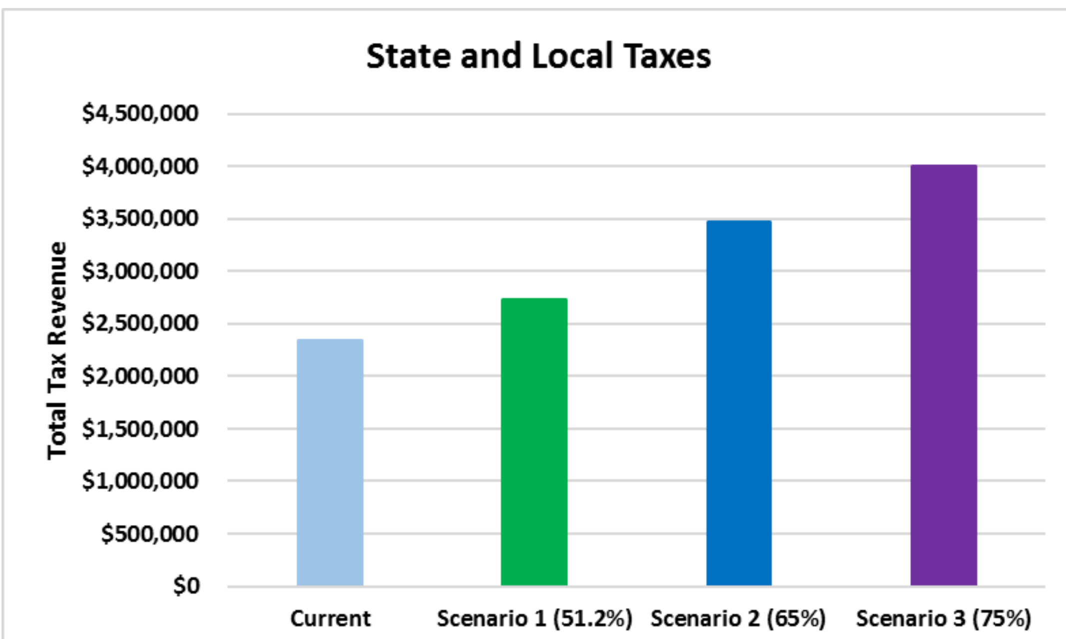


Figure 5: Total State and Local Tax Revenue by Recycling Scenario



Appendices

Appendix A: Use of IMPLAN in this study

IMPLAN is a regional impact model that enables the evaluation of the economic impact of specific activities such as construction or operation of public works projects, as well as retail, wholesale, manufacturing, and service sales within an economy. IMPLAN was originally developed by the U.S. Department of Agriculture, the Forest Service in cooperation with the Federal Emergency Management Agency (FEMA), the U.S. Department of Interior Bureau of Land Management, and the University of Minnesota to assist the Forest Service in land and resource management planning.[xliv]

The basic data sources for the current edition of the IMPLAN database and the models used in this study are the Input-Output Accounts of the United States, developed by the U.S. Department of Commerce, Bureau of Economic Analysis (BEA), and county income and employment data published by BEA and the Bureau of Labor Statistics (BLS). The model reflects 2017 industrial structure and technology, and 2017 prices. Trade flows and the results of this analysis were adjusted to reflect prices of the respective years. Economic output values and state and local tax revenues are presented in 2018 dollars.

IMPLAN uses a 536-sector input-output model to measure the effects of three types of impacts: direct, indirect, and induced. Direct impacts consist of employment and purchases of goods and services in the region resulting from the activity being evaluated, in this case, the collection and reuse of scrap materials and their associated employment. Indirect (inter-industry) impacts consist of goods and services purchased by the firms, which supply inputs consumed in the direct activity. Induced impacts consist of increased household purchases of goods and services in the region by employees of direct and indirect employers. The model generates multipliers, which summarize the magnitude of the indirect and induced effects generated by a given direct change, to estimate changes in output, income, and employment. In other words, the multiplier is the ratio of total impact to direct impact.

In the IMPLAN model, inter-industry relationships (use and make coefficients) are quantified based on data on the production functions of the different industries in the region. The IMPLAN model was used to estimate multipliers based on those coefficients in the Northwest Arkansas region. Direct spending, total economic activity, total labor income, total employment, and total property income were generated by this model.

Appendix B: Recyclable Material Categories

The 2016 REI report provided a detail breakdown of recyclable material categories, subcategories, descriptions and example processes. The information presented in the 2016 REI report is displayed in Table 12[xlv] and helps illuminate the classifications for recycled materials and their circular flow.

Table 14: Categories and Descriptions of Recyclable Materials

Material Category	Material Subcategories	Material Description	Example Processes
Ferrous Metals	• Iron • Steel	Ferrous metals recovered from appliances, automobiles, steel containers, construction and other sources.	Use as a feedstock in steel mills and foundries to manufacture raw steel and castings.
Aluminum	No subcategories	Aluminum scrap from used beverage cans, other containers, transportation, construction and other sources.	Use as a feedstock in smelting operations to manufacture semi-fabricated products (e.g., ingots, slabs).
Plastics	• Polyethylene terephthalate (PET) • High Density Poly Ethylene (HDPE) • Low Density Poly Ethylene (LDPE)	Recyclable plastics recovered for recycling.	• Use in new food and nonfood packaging products • Use in new rug fibers • Use in new pipe products • Use in new composite lumber
Rubber	• Rubber crumb • Other recyclable rubber	Ground rubber produced from scrap tires used to produce rubber crumb and used in other scrap forms.	• Use in new molded rubber products • Use for playground surfacing and athletic fields
Glass	No subcategories	Glass cullet recovered from glass bottles and jars.	• Use in new glass containers • Use in new fiberglass
Paper	• Paper and newsprint • Paperboard	Recyclable paper and paperboard recovered and recycled.	Use in new paper products.
Construction and Demolition	• Concrete • Asphalt pavement • Asphalt shingles • Gypsum wallboard • Wood	Recyclable materials recovered from construction and demolition waste.	• Use in road construction • Use in new building products
Electronics	• Computers • Hard copy devices • Televisions • Mobile devices	Recyclable electronics that are recovered for refurbishing, remanufacturing or resale.	Refurbishing, remanufacturing and resale as substitute for new equipment.

Food and Organics **Donated Food**	• Gleaned produce • Rescued food • Salvaged food	Produce, prepared food and salvaged food recovered from farms, wholesalers, retailers and food service facilities that otherwise would have been wasted.	Delivery to people in need through community food service programs.
Food and Organics **Recyclable Organics**	• Animal by-products • Crop residue • Dairy by-products • Deceased animal stock	Recyclable by-products from food processing, spoiled food that is no longer edible, grease and other cooking waste and organic material (food waste and yard trimmings) diverted from the solid waste stream.	Use in producing minimally processed animal feed, rendering and animal by-product processing, biofuels manufacturing, anaerobic digestion, compost.

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