

Measuring statewide impacts of reuse

Reuse Minnesota

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Executive Summary

Reuse is the continued use, repair, or repurposing of items or materials which extends the life of resources and decreases demand for new production. These activities result in environmental, economic, and social benefits.

With this study, Reuse Minnesota intended to refine the methodologies of previous studies conducted by Reuse Minnesota and the Minnesota Pollution Control Agency. The goals were to obtain updated results on the statewide impacts of reuse and create a user-friendly tool that will allow Reuse Minnesota to replicate the study in future years. Reuse Minnesota contracted Eunomia Research & Consulting (Eunomia), an international circular economy consulting firm, to conduct this study. Refinements to previous studies included:

- **Changing the model:** Previous studies utilized the Carnegie Mellon Economic Input-Output Life Cycle Assessment. At the recommendation of Eunomia, this study made the switch to the United States Environmentally-Extended Input-Output model. This model has been more recently updated (Carnegie Mellon is no longer updated), is free of charge, provides a clear methodology, and the matrices can be downloaded into Microsoft Excel. All these aspects were determined to support the switch for making the change, though it was acknowledged it may make comparison with past results somewhat difficult.
- **Weightings:** To acknowledge and right-size the important contribution of reuse within businesses that cannot be classified as strictly reuse businesses, a percentage-based weighting system was established.
- **User-friendly tool:** Eunomia developed an Excel model that combines the various data sources discussed in the report. This tool can be utilized by Reuse Minnesota to analyze future data and shared with other entities wishing to run similar studies.

Data on more than 13,000 businesses in Minnesota were pulled from the Dun & Bradstreet database for analysis in the tool. Overall, the research shows that the reuse economy continues to have strong positive environmental, economic, and social benefits in Minnesota.

Environmental Impacts

- Avoidance of approximately 500,000 metric tons of carbon dioxide equivalent emissions per year.
- The rental sector has the highest revenue of reuse businesses as well as the highest emissions avoided.
- The reuse sector reduces the need for 24 billion liters of freshwater withdrawals, mostly due to the avoidance of making new products.
- The Twin Cities Metropolitan Area has the greatest emissions avoided through reuse, with 66% of the total for the state. This was expected due to it being the state's largest population center and economic hub.

Economic Impacts

- The reuse economy in Minnesota is estimated to create **between \$3.1 and \$4.7 billion** in revenue per year.
- The reuse sector creates **between 36,000 and 54,000 jobs** per year.

Social Impacts

- Reuse jobs are usually not outsourced because they handle existing products within a given region. Therefore, **reuse jobs are inherently local and provide a direct benefit to the Minnesota state economy.**
- Social value added (i.e., benefits such as taxes, wages, and shareholder profits) is estimated at **\$2.4 billion.**

1.0

Introduction



With increased attention in recent years on the negative effects of single-use materials, reusable products have gained momentum and revived initiatives such as refillable packaging and reusable shopping bags. Rising awareness of the significant climate impacts caused by manufacturing of new products from clothing to electronics to building materials highlights the essential role of rental, repair, and resale in the circular economy. These reuse actions extend the usable life of existing items and decrease demand for new production.

Reuse Minnesota, founded in 2012, is a 501(c)(3) non-profit that works to advance regenerative, reuse-centered communities in Minnesota by bringing attention to and connecting reuse businesses across the state. They work on behalf of repair, resale, and rental businesses to promote the reuse economy in Minnesota and beyond. Their work complements circular economy efforts across the nation and is supported by the State of Minnesota and U.S. Environmental Protection Agency (EPA), both of which place source reduction and reuse atop the waste hierarchy as the preferred method for managing materials sustainably.¹

To inform their efforts, Reuse Minnesota contracted Eunomia Research & Consulting (Eunomia), an international circular economy consulting firm, to perform a statewide quantification of the reuse sector to measure success of current efforts and provide a baseline against which to measure future improvements.

The Minnesota Pollution Control Agency (MPCA) conducted a study in 2011 entitled “A Study of the Economic Activity of Minnesota’s Reuse, Repair and Rental Sectors,”² with an update in 2015. Reuse Minnesota built on this work and completed a 2020 study entitled “Environmental, Economic, & Social Impacts of Reuse in Minnesota.”³

This study intended to refine the methodologies of the previous studies, provide updated results on the statewide environmental, economic, and social impacts of reuse activities, and create a user-friendly tool that will allow Reuse Minnesota to replicate the study in future years. By using the same methodology to create comparable datasets, reuse data can be assessed across the state on a year-over-year basis, providing insight into changes in the scale of the reuse sector and its relative impact on the state’s environment and economy.

This report provides an overview of the 2022 study and is structured as follows:

- Section 2.0 outlines the methodology used to undertake the study
- Section 3.0 provides the results of the environmental, economic, and social impact assessment
- The Appendix provides further information on datasets used for reference in this study

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR). The Trust Fund is a permanent fund constitutionally established by the citizens of Minnesota to assist in the protection, conservation, preservation, and enhancement of the state’s air, water, land, fish, wildlife, and other natural resources.

¹ <https://www.epa.gov/smm/sustainable-materials-management-non-hazardous-materials-and-waste-management-hierarchy>

² “Economic Activity of Minnesota’s Reuse, Repair and Rental Sectors” (2011 study), <https://www.pca.state.mn.us/sites/default/files/p-rrr1-02.pdf>

³ “Environmental, Economic, & Social Impacts of Reuse in Minnesota” (2020 study), <https://reusemn.org/impact-report>

2.0

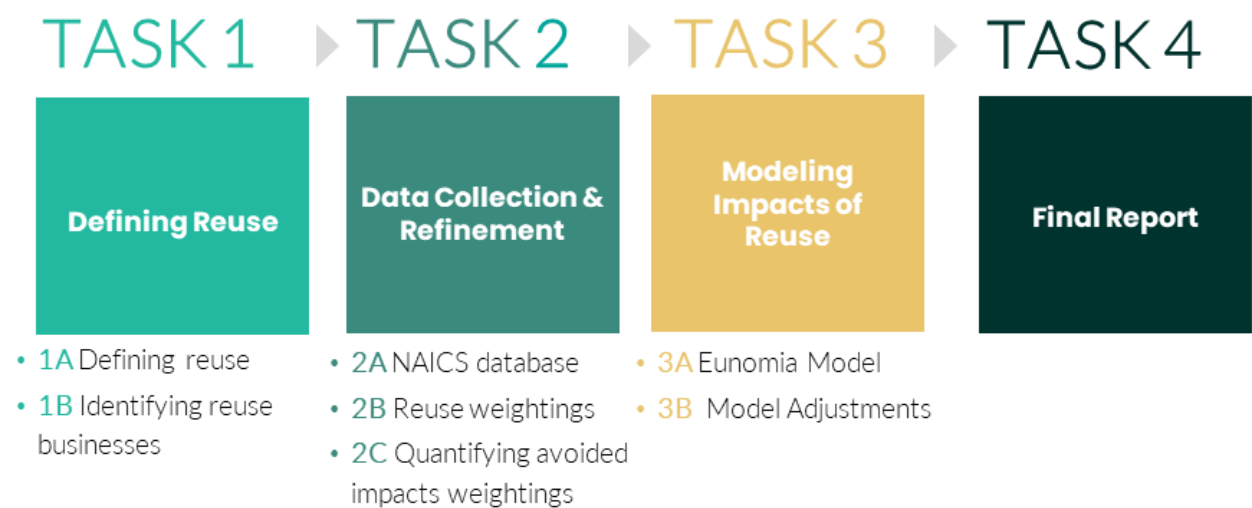
Methodology



2.1 Overview of methodology

The methodology to measure the statewide impacts of reuse in this study was created through process in Figure 1.

Figure 1: Methodology overview

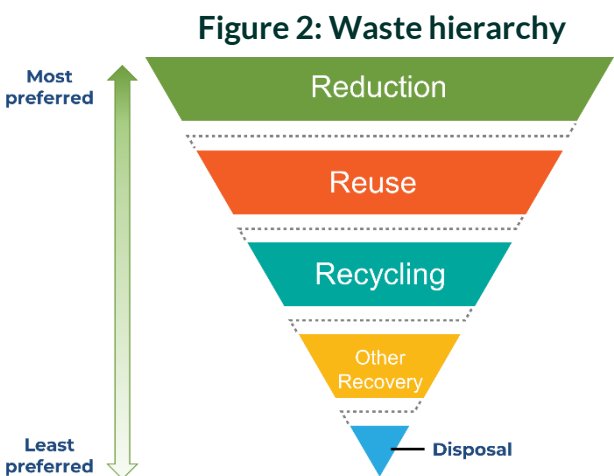


While creating a tool to measure reuse impacts was the main objective of the study, ample time was spent by the team from Eunomia and Reuse Minnesota on tasks 1 and 2 to ensure that the industries included best reflected the businesses that were actually engaged in reuse activities to provide as accurate a picture of the true impact of reuse in Minnesota as possible.

2.2 Defining reuse

Reuse is a broad term with many interpretations. Though it has recently become a buzzword in sustainability, reuse is not new, but well-established in Minnesota and across the world. Reuse extends beyond the recent focus on packaging and is much broader, including diverse sectors such as repair, rental, and sales of used products. To determine what qualifies as a reuse business and to quantify their impact in Minnesota, a definition needed to be established first.

For this study, a long list of definitions of reuse was compiled from over 30 global sources. This list is provided in the A 1.0 and includes a list of definitions from cities, towns, provinces, regional governments, working groups, and organizations. In



pursuing the circular economy, reuse is considered in terms of its position in the waste hierarchy (as shown in Figure 2) and its relationship to diverting waste. The U.S. EPA places source reduction and reuse atop the waste hierarchy as the preferred methods for managing materials. This positioning was taken into account when determining a working definition for this study to guide the research in alignment with Reuse Minnesota's goals and the prioritization of reuse in the future.

In the 2020 report, the following language was used: "Reuse, including rental and repair, extends the life of products and decreases the demand for manufacturing new replacements." This definition is useful in its breadth to take into account the variety of businesses engaged in reuse in Minnesota overall. However, for this study, a more specific definition of reuse was required against which justification was made for including or excluding certain business categories.

A review of existing definitions of reuse was conducted and discussed in relation to the objectives of the study. Based on discussions, the following definition of reuse was chosen for the purposes of this report:

"The continued use, repair, or repurposing of items or materials which extends the life of resources and decreases the demand for new production."

In this definition, the likelihood of the used product specifically reducing the purchase of a new product is highlighted.

Identifying reuse businesses

The diversity of activities that can qualify as reuse and the lack of consistent data tracking reuse make it difficult to accurately assess the financial, environmental, and social impacts of the sector. Therefore, this study began by qualifying businesses to include in the assessment.

The 2011 Minnesota Pollution Control Agency (MPCA) report defined reuse businesses as organizations involved in the following activities:

- Reselling an item provided by an original owner either through consignment or through donation of the item to a charitable or community group
- Salvaging and refurbishing materials to extend their life and reduce the overall first costs of constructing materials and products
- Extending a product's life through repair so it can be used longer and replace the need for a new item
- Renting an item for short-term use as an alternative to purchasing that item new

The 2020 report used the same defining factors as the 2011 study but made three adjustments to their interpretations of the businesses classified as reuse businesses. This approach removed the automotive businesses, which overwhelmed the results of the 2011 study, and added additional businesses involved in, but not dedicated to, reuse economy initiatives. While these amendments improved the results of the study, there were some drawbacks as well, such as including impacts not associated with reuse from the business in the latter categories.

To determine what qualifies as a reuse business, the established definition was used as a guide against which to assess a business's activities. Utilizing Reuse Minnesota's local insight, the 2020 report, and Eunomia's

expertise, a long list of industries was created which included businesses that were likely to include reuse as all or part of their business. This list was further refined and amended when assessing the North American Industry Classification System (NAICS) codes to include as inputs to the model, as described in Section 2.3.1.

2.3 Data collection and refinement

2.3.1 NAICS database

2.3.1.1 Data collection

To access business data to calculate the associated revenue and employment information of reuse businesses, this study used NAICS codes and purchased the data associated with the selected industries from Dun & Bradstreet Corporation (D&B). NAICS is a universal numbering system that helps identify the industry affiliation of a company, and is the standard used by federal statistical agencies to classify business establishments for the purposes of collecting, analyzing, and publishing statistical data related to the U.S. business economy. Companies self-identify their business under their primary and sometimes secondary income-producing business activities through the corresponding NAICS codes.

D&B is a global company that provides business intelligence products through its database and analytics software and has the most comprehensive NAICS database with 1,170 industries. Therefore, this source was chosen to provide the NAICS code-associated data for Minnesota reuse businesses.

The data provided from the database for this study for each business under the chosen NAICS codes included:

- Business name
- Location data
- Sales date
- Number of employees
- Industry classifications

Refinements to this data are described in Section 2.4.2.

2.3.1.2 Industry selection

Before the data could be purchased through the D&B database, industries associated with reuse were identified. This process involved first selecting the eventual list of NAICS codes used in this study.

The categories used in the 2020 report were used as a starting point, reviewed and analyzed to determine which should be included, excluded, and any new codes to be added through several rounds of discussion and evaluation between the Eunomia and Reuse Minnesota teams. Many of the broader NAICS codes covered a range of industries, some of which would not be considered reuse or repair. Multiple rounds of refinements

were completed to determine which businesses would be best suited for our analyses within these code classifications.

Then, extensive evaluation of outputs from the D&B database was undertaken to determine the appropriate search terms and categories to produce the desired sectors and industries. Once this was determined, Reuse Minnesota staff downloaded the data from the D&B database in a series of Excel files. The selected codes were then updated to the corresponding categories in the NAICS 2022 database and converted to be integrated into the model.

Table 6 in the Appendix provides the full list of the various data extracts that were pulled from D&B, the weightings and the refinements applied to provide the final list of nearly 13,000 businesses in Minnesota.

Businesses pulled by NAICS codes

The first step to creating a list of reuse businesses was to pull corresponding businesses based on relevant NAICS codes and refine as necessary. Table 1 provides a list of the specific NAICS codes searched. Additional businesses were then added via the methods below.

Table 1: NAICS Codes Searched

Category	NAICS Codes Searched
Rental	Consumer electronics and appliances rental (532210)
	Formal wear and costume rental (532281)
	Video tape and disc rental (532282)
	Home health equipment rental (532283)
	Recreational goods rental (532284)
	All other consumer goods rental (532289)
	Office machinery and equipment rental and leasing (532420)
	General rental centers (532310)
	Other commercial and industrial machinery and equipment rental and leasing (532490)
Repair	Tire retreading (326212)
	Printing and machinery equipment manufacturing (333244 – refined with “repair”)
	Other industrial machinery manufacturing (333249)
	Industrial machinery and equipment merchant wholesalers (423830 – refined with “repair”)
	Service establishment equipment and supplies merchant wholesalers (423850 – refined with “repair”)
	Consumer electronics repair and maintenance (811211)
	Computer and office machine repair and maintenance (811212)
	Communication equipment repair and maintenance (811213)
	Other electronic and precision equipment repair and maintenance (811219)
	Commercial and industrial machinery and equipment (except automotive and electronic) repair and maintenance (811310)
	Home and garden equipment repair and maintenance (811411)
	Appliance repair and maintenance (811412)
	Reupholstery and furniture repair (811420)

Category	NAICS Codes Searched
	Footwear and leather goods repair (811430) Other personal and household goods repair and maintenance (811490)
Resale	Used merchandise stores (455310) Motor vehicle parts, used (423140)
Book Stores	Book stores (451211)
Bridal	Clothing Stores (44810 – refined with “bridal”) Women’s Clothing Stores (448120 – refined with “bridal”) Children’s and Infants’ Clothing Stores (448130 – refined with “bridal”) Family Clothing Stores (448140 - refined with “bridal”) Clothing Accessories Stores (448150 – refined with “bridal”) Other Clothing Stores (448190 – refined with “bridal”)
Passenger Car Rental	Passenger car rental (532111)
Recreational Vehicles & Boats	Recreational Vehicle Dealers (441210) Boat Dealers (441222)
Sporting Goods	Sporting Goods Stores (451110)
Used Car Dealers	Used Car Dealers (441120)

Businesses pulled through keyword searches

In addition to specific NAICS codes, keyword searches were employed to search for businesses that may use primary NAICS codes that were not included in those selected for the study.

- Auction: Refined to remove NAICS for livestock (424520) and real estate brokers (531210)
- Pawn: No refinements by NAICS

Other

As in the 2020 report, it was important to ensure Reuse Minnesota member businesses were included. Some do not fall under one of the NAICS or keywords, so a search list was compiled of these businesses and then run to pull any that had not previously been downloaded in other lists.

After spot checking all the downloaded data from the aforementioned searches, there were a few businesses that were found to have not been pulled. These include three Habitat for Humanity ReStore locations and a used art supply nonprofit, which were added to the resale data, and HOURCAR (car sharing organizations), which was added to the rental data.

Used car sales and auto repair

As in past reports, a significant amount of discussion was had regarding whether or not to include data related to automobiles, such as used car sales and car repair. These categories are distinct from one another in that

used car sales are often displacing the purchase of a new vehicle. Whereas auto repair does not usually displace the purchase of a completely new vehicle, since the cost of repair is often less than purchasing. It is recognized that this is not always true, such as the case of an engine replacement which can exceed the value of the car but examining data at a more granular level was not possible within the confines of this study.

With this in mind, it was decided to purchase and include data for used auto dealers (NAICS 441120), but to keep it separate from other resale data. With potentially high revenues for this sector, this was done so it would not skew the other resale data in misleading ways. Approximately 670 used auto dealers were included in the data. Auto repair and auto parts stores were excluded, in part for the aforementioned reasons, but also the sheer number of repair shops being around 7,700, it was felt the data would overwhelm the outcomes of the study and was not worth the additional cost to purchase.

2.3.1.3 Data quality limitations and mitigation

Even though D&B is the most cited source for NAICS code data, there are limitations associated with the data in terms of quality. Through manual evaluation of the data, there were some inconsistencies and inaccuracies that were identified. Reuse Minnesota and Eunomia took measures to mitigate data quality issues as much as possible. Issues and mitigation measures were as follows:

- *Out-of-date business data.* The D&B outputs included some businesses that the team identified as having been out-of-business. D&B cross-checks their data with business licenses, but this is not always updated regularly. Since the process to identify such businesses and remove them would be a manual effort involving research on each individual business, limited mitigation was taken on this issue.
- *Duplication of revenue or unrepresentative aggregation.* For some businesses with multiple branches, the revenue for the entire company was provided, either for *all* branches, or all branches were compiled into one branch. To address these instances, Eunomia undertook an outlier assessment, removing data points with unrealistic (above or below 100 times the median, value subject to change) value for *\$ revenue per employee*. This exercise was performed for each sector.
- *Inaccurate reporting of employees.* While sense-checking the data, it was found that there were some businesses in which the number of employees reported was unrealistically high for the town or county in which the business was located. This was found to be especially significant for Goodwill stores; possibly due to their involvement in other lines of business beyond their donation centers/used good retail locations. Since Goodwill is such a large contributor to the reuse economy, Reuse Minnesota reached out to the organization to confirm employee counts for their stores across the state and replaced the incorrect data with the actual data provided by the organization.⁴

While actual data was included whenever available in both the D&B database and the extracted database for this study, some of the data is modeled based on best-available information.

Given the data quality limitations and the frequency with which NAICS code data is updated, this study may only provide value if updated periodically, rather than annually, in an attempt to measure actual trends rather than natural variations in the data. Both Eunomia and Reuse Minnesota recommend a frequency of every five years.

⁴ To note: Some Goodwill data reflects sales resulting from e-commerce activities based out of Minnesota locations. The impact of this business line is more difficult to account for in the impact study but may of interest to address in future studies, especially as the amount of online sales increases, including for smaller businesses.

2.3.2 Reuse weightings

In the previous studies, all activities of businesses included in the data were attributed to reuse. A challenge that arises with this approach is the reality that many businesses cannot be neatly classified as solely reuse businesses due to some of their activities or their reuse activities may not displace the production of new items.

In some cases, businesses have a small to moderate portion of their activities associated with reuse but are not classified as strictly reuse businesses. An example is bookstores, many of which offer used book sales, but a large amount of their economic activity is the sale of new books or other items.

Similarly, there are businesses where all activities could be seen as reuse, but where the likelihood those activities are displacing the production of new is very low. An example is the car rental sector. While all of the business activity is rental, it was assumed that most individuals renting a car are not displacing the purchase of a vehicle by renting. They may be renting for a work trip or while a personal vehicle is being repaired, and it would not be assumed that most individuals using a car rental service would otherwise purchase a new car were that service not available. On the other hand, there are individuals who do in fact utilize rental to avoid purchasing a vehicle, often to compliment other modes of transportation on an intermittent basis. Therefore, these businesses should not be completely excluded.

To acknowledge and right-size the important contribution of reuse within these business, five percentage-based weighting categories were established. While determining the categories and appropriate percentages, business types were reviewed by NAICS code and in other cases by keywords (e.g., pawn). These were then held up against the study definition of reuse to determine if the activities extend the life of resources and decrease the demand for new production. The weightings were applied to the revenue of the businesses included in the assessment. These considerations regarding the reuse weighting represents an improvement on the 2020 study which did not take these into account.

It should be noted that these weightings are based on assumptions made about business types as a whole and may obscure individual business realities. For example, bookstores that are solely engaged in used book sales would not have all of their revenue included, but it was assumed that this would be offset by businesses in the same category that engaged in little or no reuse activities.

Table 2: Reuse weightings

Category	Weighting	Description	Examples of business types included
1	100%	Businesses where all or most revenue comes from reuse activities.	Used Merchandise Stores, Video Tape and Disc Rental, and Reupholstery and Furniture Repair.
2	60%	Businesses where a significant proportion of the revenue comes from reuse activities.	Office Machinery and Equipment Rental and Leasing and Recreational Goods Rental.

Category	Weighting	Description	Examples of business types included
3	20%	Businesses where a small proportion of the revenue comes from reuse activities.	Recreational Vehicle Dealers and Book Stores.
4	5%	Businesses where a nominal proportion of the revenue comes from reuse activities.	Passenger Car Rentals and Leasing.
5	0%	Businesses where none of the revenue comes from reuse activities.	Businesses were excluded.

2.3.3 Quantifying avoided impacts

To quantify the environmental and social impacts at the state level, and given the available data, a financial-based modeling approach was required. This entailed combining the financial data (described above) with impact factors (e.g., GHG emissions per dollar spent on production of a good) for different sectors of the economy (e.g., Sporting Goods Retailers). There are multiple environmentally-extended input-output (EEIO) models of various geographic and temporal relevance which produce these impact factors.

The 2020 study used the Carnegie Mellon Economic Input-Output Life Cycle Assessment (EIO-LCA) model, a widely used EEIO model first developed in 2002 and updated in 2007. However, the underlying data is no longer updated for this model, meaning that new information is not incorporated to make changes to improve the model. In addition, this model was only available for commercial use with a license and non-transferable between parties, therefore prohibiting Reuse Minnesota from subsequently editing and accessing the model for future years' comparisons. Eunomia researched additional models that would suit Reuse Minnesota's needs and would provide similar results. Models reviewed included:

- United States Environmentally-Extended Input-Output (US-EEIO) model;
- World Input-Output Database (WIOD);
- Comprehensive Environmental Data Archive (CEDA);
- Exiobase.

These models are all endorsed by the Greenhouse Gas Protocol.⁵

For this study, the most affordable and appropriate model to use was the US-EEIO model. The US-EEIO model was created by the US Environmental Protection Agency (EPA) to quantify the impacts of production and consumption, assess organization-wide impacts, analyze environmental impacts of policies, and to perform streamlined life cycle assessments. The model is free of charge, provides a clear methodology, and the matrices can be downloaded into Microsoft Excel, allowing integration with the Eunomia-created model to further refine outputs. Additionally, the model uses relatively up-to-date data, with the most recent model (v2.0) using some environmental data as recent as 2016.⁶ The US-EEIO model is also capable of producing 23 indicators or

⁵ <https://ghgprotocol.org/calculation-tools>

⁶ W. Ingersen et al., (2022) *USEEIO v2.0, The US Environmentally-Extended Input-Output Model v2.0*. Available at: <https://www.nature.com/articles/s41597-022-01293-7>

social, economic, and environmental impacts, including GHG emissions (kgCO₂e), Freshwater Consumption (liters), and Social Value Added (\$). While the Carnegie Mellon EIO-LCA model is still valid and used, the US-EEIO model has more up-to-date baseline data from 2013 and is more extensive in its coverage of resources and emissions. This model also uses a range of data sources which cover 385 total US goods and services.

While the Carnegie Mellon model and US-EEIO model are generally comparable, the differences between the two models may be significant. An informal (but detailed) comparison between the methodologies and expected results between the Carnegie Mellon EIO-LCA model and the US-EEIO models has been published online and a Table 3 provides a comparison of the Carnegie Mellon EIO-LCA model used in the 2020 study and the US-EEIO model used in this study.⁷ The models were developed separately, meaning a succinct summary of their similarities and difference is difficult, however it is worth noting that one key reason for differing results is from the data itself; in other words, the environmental benefit results from the US-EEIO model tend to be lower because the GHG intensity of US production has (in general) lowered since the time when the Carnegie Mellon and US-EEIO models were produced and the emission factors were calculated. To determine the impact on the results of using the US-EEIO factors, alternative results were calculated using the Carnegie Mellon model as part of a “sensitivity analysis” in this study (see Appendix A 3.0).

Table 3: Comparison of Models

Category	Carnegie Mellon EIO-LCA	US-EEIO
Inputs	Dun & Bradstreet business revenue data	Dun & Bradstreet business revenue data
Outputs	GHG emissions (measured in 5 types); air pollutants; Water withdrawals avoided; Business revenue and jobs created	GHG emissions (measured in 14 types); air pollutants; Land, water, energy, mineral resource use; Value added (\$), jobs created
Cost	\$10,000 license fee	Free
Baseline dataset	2002 benchmark input-output table provided by the Bureau of Economic Analysis (BEA); EPA National Emissions Inventory (NEI) 2002 data	2007 benchmark input-output table from BEA; EPA National Emissions Inventory (NEI) 2013 data
Year Created	2007	2017
Use in Excel	No	Yes

2.4 Modeling impacts of reuse

⁷ Yu Gan and H. Scott Matthews (2018) *A Comparison of Methods and Results from the 2007 Benchmark USEEIO model and the 2002 EIO-LCA Model*. http://www.eiolca.net/docs/USEEIO_EIO-LCA_Comparison_Report_May2018.pdf

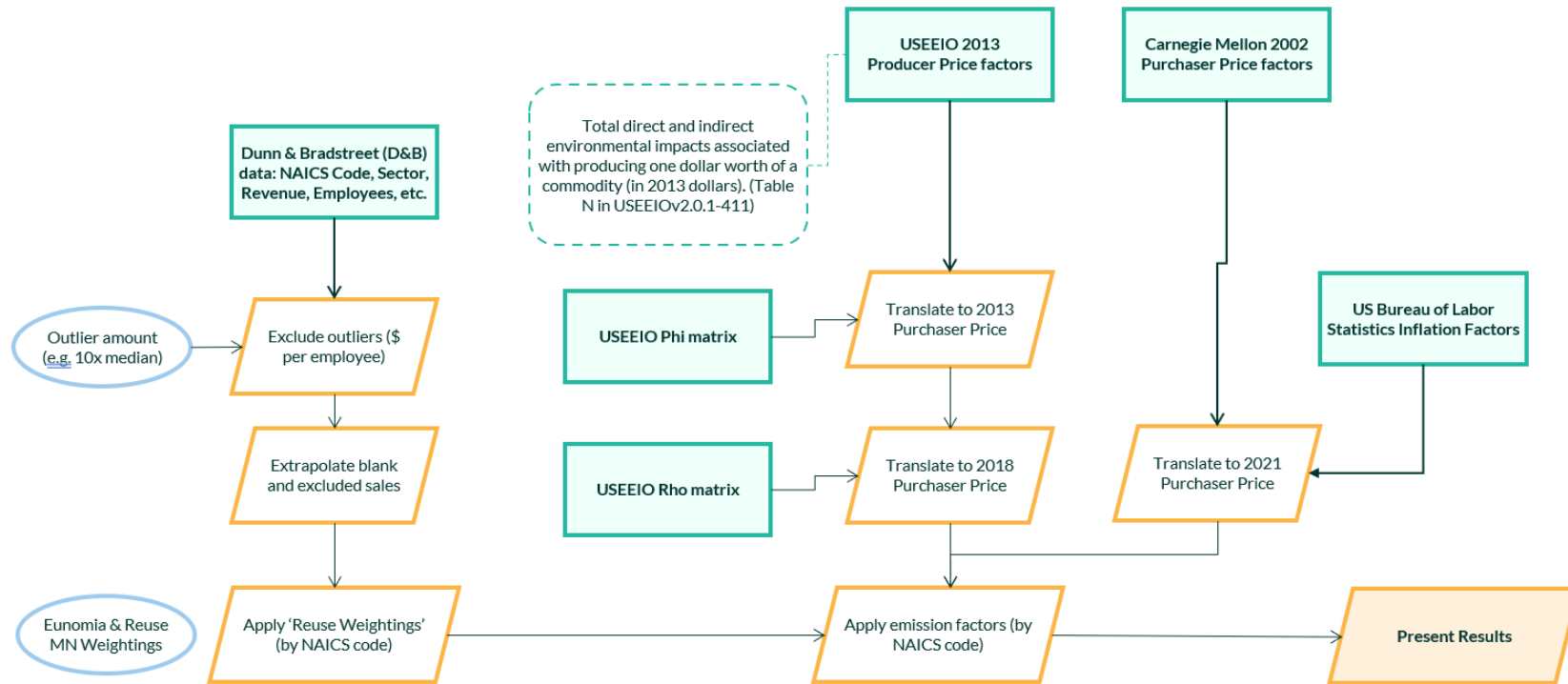
To assess the social, economic, and environmental impacts of reuse in Minnesota, a standardized model was needed to translate business information into comparable economic and environmental statistical outputs.

2.4.1 Eunomia model

Eunomia developed an Excel model that combines the various data sources discussed above.

Figure 1 illustrates the modeling process: starting with the D&B data, cleaning it for blanks and outlier revenue/job values, combining it with (adjusted) US-EEIO (and Carnegie Mellon) emission factors, and presenting results.

Figure 1: Modeling Process



Many of these processes have been described above, alongside their associated data source.

The two adjustments of the emission factors require further explanation:

- The Producer Price (in which the emission factors are provided) required translation into the Purchaser Price (which was assumed to be equivalent to Revenue) so as not to overestimate impacts.
 - NAICS-specific conversion factors are provided in the US-EEIO v2.0 model (within the 'Phi' matrix)
- The 2012 (or 2002 for Carnegie Mellon) values needed to be adjusted for inflation to prevent overestimation of impacts.
 - NAICS-specific inflation factors were provided in the US-EEIO v2.0 model (within the 'Rho' matrix). Alternatively, for simplicity, a US-wide inflation factor was applied to the Carnegie Mellon results, as the Carnegie Mellon factors were not available in the same NAICS-code format.

The outputs of the Eunomia model are presented in the following section. In addition to headline/state-wide results, results can be broken down by region, sector, NAICS code, and other factors. The model also performs some sensitivity analysis to illustrate the range of potential results.

2.4.2 Model adjustments

After the NAICS code business data was fed into the model, several adjustments were made to the functionality of the model to provide outputs that are as accurate as possible. These included:

- Applying predetermined category weightings to D&B businesses
- Translating these values to 2018 Purchaser Price using values using the US-EEIO Rho matrix (a sector-specific inflation adjustment matrix)⁸
- The D&B NAICS codes are auto-matched to the US-EEIO purchaser prices; values that are not automatically matched are compared using Eunomia's mapping assumptions
- Mapping emissions factors, including CO₂ equivalent, GHG, air pollution, fine particulate matter (PM_{2.5}) equivalent, and water use

To further refine the results of the overall estimation, data cleansing was applied to the financial data (which was not applied in the 2011 and 2020 studies). For each sector, we identified outliers by identifying *revenue per employee* values that were unrealistically low or high.

The adjustments attempted to account for the data limitations as much as possible. However, the results provided are one possibility based on many unknowns. To show the full spread of possible results, a sensitivity analysis was conducted.

Figure 2 illustrates the impact to the total revenue as the adjustments were applied to address some of the data limitations.

⁸ 2018 is the most recent year of available inflation data in the Rho matrix.

Figure 2: Revenue adjustments

Metric	Value	Notes
Raw Data Revenue (\$)	\$5,633,852,934	Raw data, as exported from D&B [Sep2022: plus manual edits of Goodwill data]
Cleaned Revenue (\$)	\$4,737,979,620	Raw data with blank Sales filled in and outliers replaced
% change from raw data	-16%	
Weighted Revenue	\$3,081,244,714	Weightings applied to Cleaned Revenue
% change from raw data	-45%	

3.0

Results



The results of the environmental, financial, and social impacts analyses are presented below. This report used industry best practices to model the impacts of reuse businesses, and each analysis includes ranges and context to account for as many uncertainties as possible. It is most useful to view these results in the context of the US-EEIO model and to use this report as a baseline against which future assessments of the impacts of reuse in Minnesota can be measured or compared to against other states.

3.1 Environmental impacts

In addition to the reduction of waste associated with disposal, reusing products results in the avoidance of the creation of new products. This is important to note, since the greatest climate impacts for most products are from the production, and in some cases, the use of goods, not from the waste generated at end-of-use. Therefore, reuse leads to an avoidance of GHG emissions associated with the production of those products and provides an environmental benefit. This report also considers the environmental impact of a reduction in freshwater withdrawals, which are associated with the production of new products.

3.1.1 Greenhouse gas emissions avoided

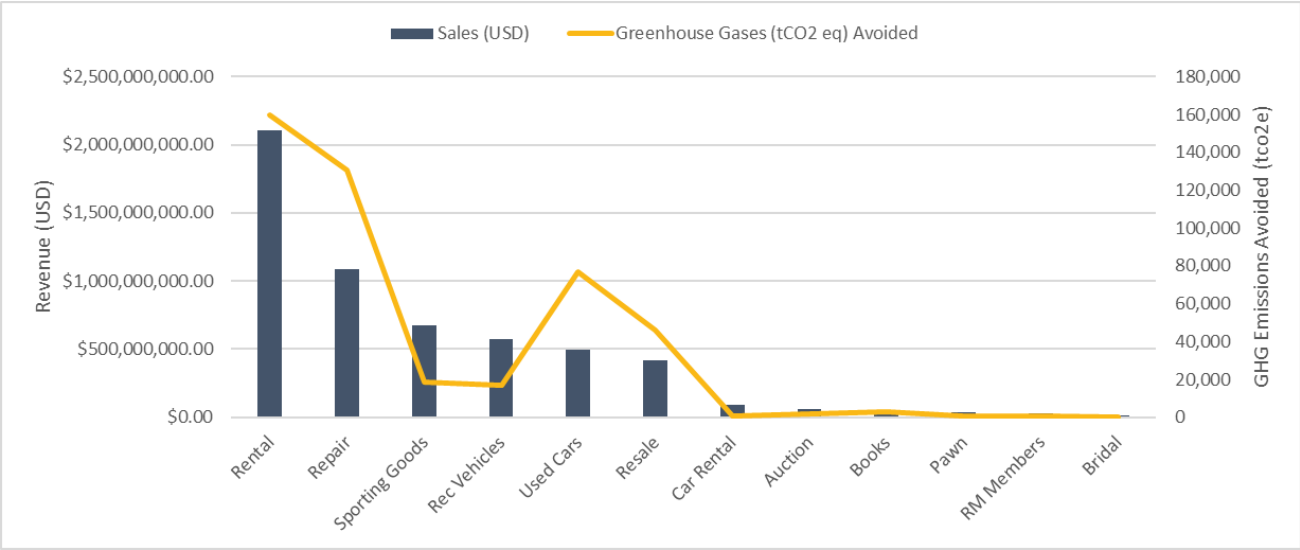
The reuse economy in Minnesota is responsible for avoiding GHG emissions of approximately 500,000 metric tons of carbon dioxide equivalent (mtCO_{2e}) each year, or roughly 95 kilograms (kg) CO_{2e} per Minnesotan. This is equivalent to the impact of taking over 100,000 gas-powered passenger vehicles off the road per year. Given the nature of global supply chains for the production of new goods, it is difficult to quantify what percentage of these emissions are directly avoided in the state of Minnesota. However, it is comparable to 0.3% of GHG emissions that are generated annually in Minnesota (160,000,000 mtCO_{2e}).

The estimate of ~500,000 mtCO_{2e} avoided is roughly 80% lower than the estimate from the 2020 study of 2,771,157 mtCO_{2e}. This is due to changes to the methodology between the two studies, specifically resulting from:

- *Moving from Carnegie Mellon to the US-EEIO.* While both models are recognized as providing acceptable GHG estimates, the latter database presents lower emissions intensities due to the fact that it is based on more recent actual data, which is typically of lower intensity, as well as other differences in how the two models are built.
- *Adjusting the EEIO emission factors for inflation.* By acknowledging that the buying power of a dollar today is less than it was in 2002 or 2013 due to inflation (i.e., you can get less for a dollar today than you could years ago), it must be acknowledged that there are fewer emissions associated with a dollar spent today than in the past.
- *Producer price adjustment.* In the 2020 study, revenue was essentially assumed to be equal to producer price, meaning impacts were overestimated because the additional 'markup' of a retailed product was essentially being associated with actual production.
- *Weighting revenue.* Instead of applying 100% of the revenue associated with businesses that had some reuse, this study developed *reuse weightings* for certain sectors to account for the fact that not all of the business activities would be related to reuse or that the purchase or rental of reused items did not displace the production and purchase of new items.

There are many ways to break down the results according to the data categories present in the financial data. Figure 3 presents the breakdown of results by sector (NAICS codes were grouped into sectors by the project team, as shown below). The figure shows both GHG emissions and sales (USD), therefore illustrating not only the overall most impactful sectors, but also the sectors that have been estimated to have the highest avoided emissions per dollar in revenue. The intensity of the sector is largely determined by the *reuse weighting* applied in this study, rather than by the US-EEIO emission factors or any other distinguishing variable.

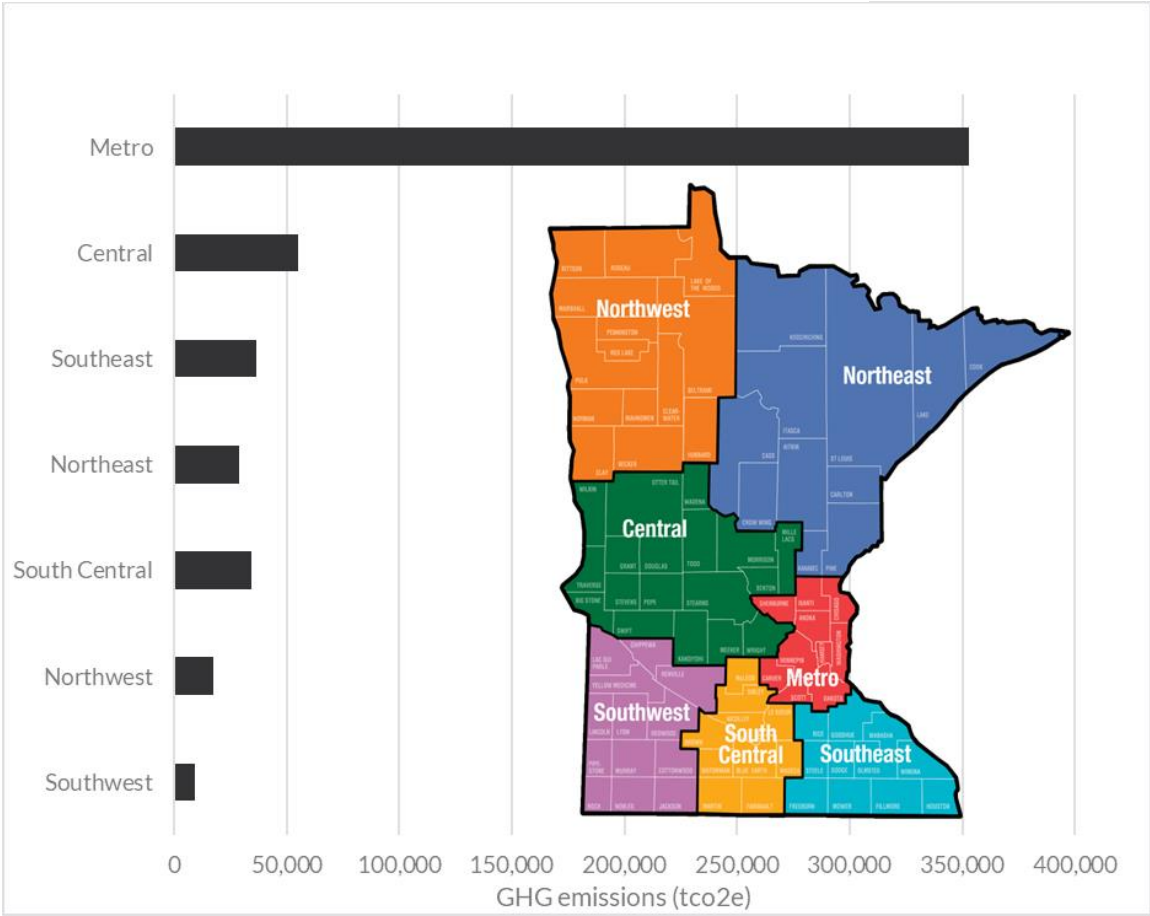
Figure 3: GHG emissions avoided by sector



As shown in the chart above, we found that the rental sector, with the highest revenue, also has the highest GHG emissions avoided. However, the intensity of emissions avoided, or the greatest difference between revenue and GHG emissions avoided, occurs in the repair and used cars sectors. This indicates that these sectors provide the greatest environmental impacts per dollar spent.

GHG emissions avoided can also be analyzed by region. Figure 4 provides a snapshot of the GHG emissions avoided by region in Minnesota, with the regions indicated in the accompanying map.

Figure 4: GHG emissions avoided by region



The Metro region has the greatest emissions avoided through reuse, with 66% of the total emissions avoided from the entire state. This result was expected due to the Metro region being the largest population center and economic hub in Minnesota. Further analysis of the drivers for regional variation may be the topic of future research using the reuse calculation model.

Using a range of analyses allows us to increase confidence in reuse emissions factors and to create a more accurate assessment. A sensitivity analysis of these results highlighting the most important variables is provided in a heatmap in Appendix A 3.0. This sensitivity matrix demonstrates that the values may be larger or smaller depending on the two key variables of:

- The impact of new products
- The reuse weighting applied to revenue

The reuse weighting applied to revenue relies on expert judgment and uses qualitative and quantitative assessments to calculate the impacts of each industry. The estimated value of 500,000 mtCO₂e represents the model results using the most conservative set of assumptions available. The sensitivity matrix illustrates the complexity of trying to determine a life cycle analysis for an entire industry or suite of industries, when the

accuracy of life cycle analyses for individual products are based on many assumptions and estimates. This study is therefore conservative in its calculations of environmental benefits.

3.1.2 Water withdrawals avoided

The US-EEIO model also allows for an estimation of the amount of freshwater withdrawals avoided. For reuse in Minnesota, this figure has been estimated at **24 billion liters**. This number represents water consumed within the global supply chain during the production of new goods and services, not the amount of water saved within the state of Minnesota boundary.

3.2 Economic impacts

Reusing products can result in increased economic benefits for the state of Minnesota. This is represented by revenue of sales of products and services associated with reuse, which contribute to economic growth in the state.

The reuse economy in Minnesota is estimated to create **between 3.1 and 4.7 billion dollars** in revenue per year. This represents an estimate of the revenue generated by Minnesotan businesses associated with reuse. This figure includes a proportion of revenue from some businesses in which only part of the business activity is estimated to be associated with reuse. As noted in the methodology, “reuse weightings” were applied to the various reuse sectors to estimate the percentage of business activity that is associated with reuse to include in the overall estimation. In reality, the weighting of the data is a complex and multi-faceted process, and more work in the future could provide a more accurate estimate of revenue associated with reuse. Therefore, 3.1 billion represents the estimated revenue with the weightings applied, whereas 4.7 billion is the full sales figure for the chosen categories without the weightings applied, to provide the greatest potential impact.

This estimate is lower than the estimate of economic impact from the 2020 study of roughly \$5.8 billion, for the methodological reasons discussed in Section 3.1.

3.3 Social impacts

In addition to stimulating the economy through spending, the reuse economy provides Minnesota with social benefits by creating jobs associated with reuse and provides a social value in added dollars to the Minnesota economy.

3.3.1 Jobs created

Reuse jobs are usually not outsourced because they handle existing products and provide local community services. Therefore, **reuse jobs are inherently local and provide a direct benefit to the Minnesota state economy.**

The reuse economy in Minnesota is estimated to create **between 36,000 and 54,000 jobs** per year. This figure has been calculated using the D&B financial data (with outliers removed). As with the economic findings, this range represents the weighted and unweighted values.

Figure 5 and Figure 6 present the results for jobs created by sector and by region. The results of this analysis mirror the pattern of economic results, especially in terms of regional and sector variation.

Figure 5: Jobs created by reuse in Minnesota, by sector

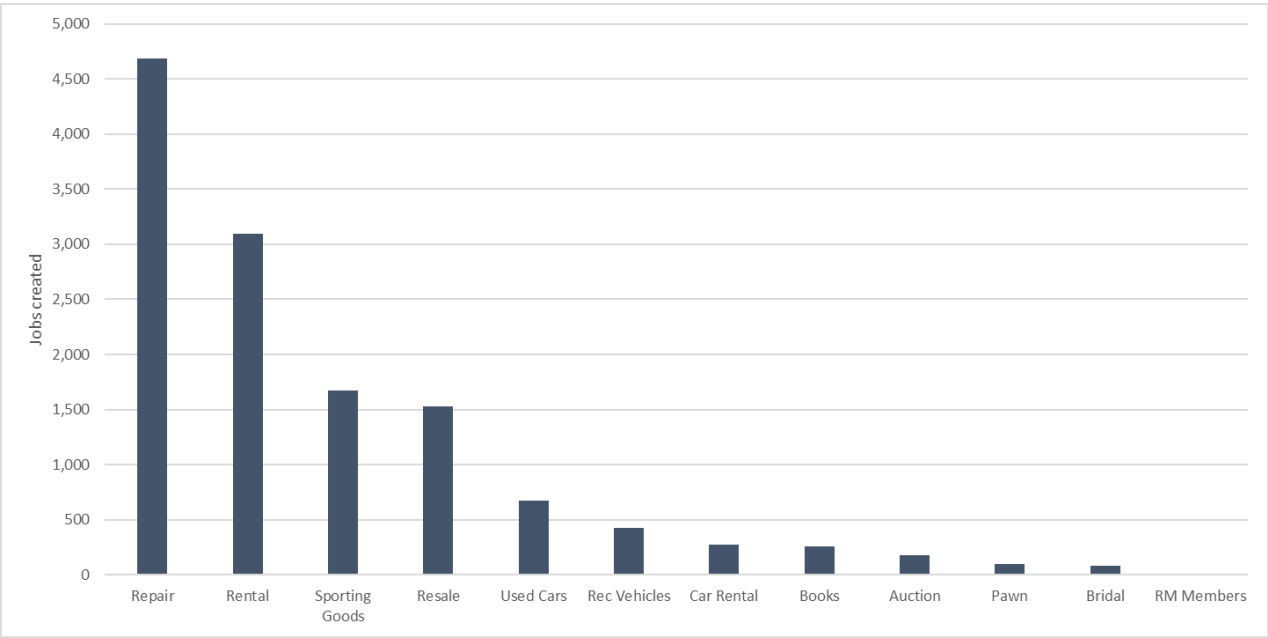
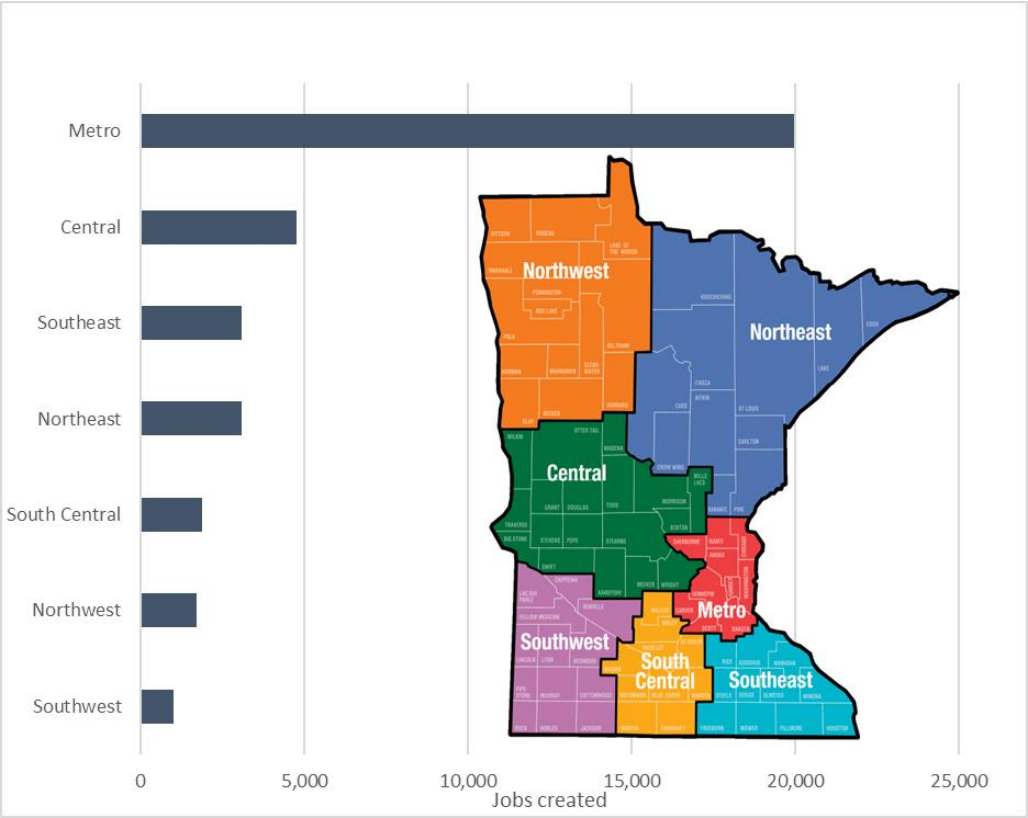


Figure 6: Jobs created by reuse in Minnesota, by region



3.3.2 Social value added

The social value added (\$) has also been calculated by using the US-EEIO model and was estimated at **2.4 billion dollars per year**. In the words of the US-EEIO model developers, this represents “a collection of the monetary benefits industries provide to government (as taxes), employees (as wages), and to their shareholders (as profits) (Anderson, 2022).”⁹ Additional research is needed to understand the estimations of the uncertainty associated with these results and therefore their utility going forward.

⁹ W. Ingersen et al., (2022) USEEIO v2.0, The US Environmentally-Extended Input-Output Model v2.0. Available at: <https://www.nature.com/articles/s41597-022-01293-7>

4.0

Takeaways



Reuse is a broad category. When applied to businesses, it includes varied and diverse businesses that contribute to the Minnesota economy.

To accurately measure reuse, a clear definition is needed to ensure that all judgments made on whether or not business data should be included in the assessment are able to be traced back to a consistent source. Putting bounds on what is considered reuse is difficult, but in this study, the use of sector-based weighting allowed for more precise measurements of the reuse economy.

Though there are still limitations and unknowns in the methodology applied, the tool created for this assessment is the most accurate measurement of the reuse sector that has been undertaken. The methodology worked to refine it as much as possible and allows for future refinement as better data is available. Some of the limitations that could be improved in the future may improve upon:

- Accuracy of the D&B data
- Accuracy of emission factors
- Accuracy of emission factor mapping
- Reuse weightings applied

This tool should be applied elsewhere, and results compared across years and states to determine the magnitude of the sector and its growth.

The results, summarized in Table 4, demonstrate the profound impact that reuse has on the Minnesota economy, environment, and community

Table 4: Summary of results

Sector	Key Findings
Greenhouse gas emissions avoided	500,000 metric tons of carbon dioxide equivalent (mtCO2e) GHG emissions each year, equating to the impact of taking over 100,000 gas-powered passenger vehicles off the road per year
Water withdrawals avoided	24 billion liters of freshwater
Economic impacts	\$3.1-4.7 billion in revenue per year
Jobs created	36,000-54,000 jobs per year
Social value added	\$2.4 billion per year

Through this assessment Reuse Minnesota has proven to be a leader in the country in understanding and promoting the reuse economy and will continue to do so going forward. As reuse continues to gain momentum, being able to track the impact of these businesses and statewide efforts will allow for additional resources and supportive policy to be created.

Appendix



A 1.0 Reuse definitions

The table below provides a selection of definitions of reuse from various sources that were consulted for this study.

Table 5: Reuse definitions

Organization/Source	Definition
2020 Report	Reuse, including rental and repair, extends the life of products and decreases the demand for manufacturing new replacements.
Minnesota Waste Management Act	Minnesota Waste Management Act Waste reduction or source reduction: An activity that prevents generation of waste or the inclusion of toxic materials in waste, including: (1) reusing a product in its original form; (2) increasing the life span of a product ¹⁰
MPCA SCORE report	Reuse: A product or material that is maintained in its original form without significant alteration, used again for its original or similar purpose, and to extend the life of a product or replace the need for a new product. Reuse is not recycling and does not alter an object’s physical form by extracting base materials for processing into a new item. AND Reuse: The continued use or repurposing of items or materials without processing (this includes resale, repair, rental, and donation of items to partners that facilitate reuse). Reuse extends the life of existing products to reduce the demand for new production and the associated environmental impacts of that manufacturing. ¹¹
Break Free from Plastic Act of 2021	Reusable: “Technically feasible to reuse or refill in United States market conditions; and reusable or refillable for such number of cycles, but not less than 100 cycles, as the Administrator determines to be appropriate for the covered product or beverage container.” ¹²

¹⁰ <https://www.revisor.mn.gov/statutes/cite/115A.03>
¹¹ <https://www.pca.state.mn.us/sites/default/files/w-sw-1-31.pdf>
¹² <https://www.congress.gov/bill/117th-congress/senate-bill/984/text>

Organization/Source	Definition
EU Waste Framework Directive	Preparation for reuse “gives used products a second life before they become waste and includes practices such as cleaning, repairing or refurbishing products or their parts without other pre-processing.” ¹³
Ellen Macarthur Foundation	Reuse: “The repeated use of a product or component for its intended purpose without significant modification.” ¹⁴
EPA (Waste Hierarchy)	Source reduction and reuse: “Source reduction, also known as waste prevention, means reducing waste at the source, and is the most environmentally preferred strategy. It can take many different forms, including reusing or donating items, buying in bulk, reducing packaging, redesigning products, and reducing toxicity. Source reduction also is important in manufacturing. Light weighting of packaging, reuse, and remanufacturing are all becoming more popular business trends. Purchasing products that incorporate these features supports source reduction.” ¹⁵
2019 New York City Reuse Sector Report	Reuse: “The use of a product more than once in its same form for the same purpose or for different purposes”
Connecticut Department of Energy and Environmental Protection	Reuse: “Any activity that lengthens the life of an item, such as using a washable mug instead of a disposable one.” ¹⁶
Los Angeles County Public Works	Reuse: “Using an item more than once” ¹⁷
North Carolina State University Extension Program	Reuse: “Taking products that would otherwise be discarded and using them again in their current form, or with few repairs or changes.” ¹⁸
Clinton County Michigan Department of Waste Management	Reuse: “The practice of using a material over and over again in its current form.” ¹⁹
Santa Barbara County	Reuse: “When a product is used again in the same form and for the same purpose.” ²⁰
Recycle Montana	Reuse: “All about finding uses for items versus discarding them into the landfill.” ²¹

¹³<http://hi4csr.com/en/blog/the-importance-of-waste-hierarchy-in-circular-economy/#:~:text=2.,parts%20without%20other%20pre%2Dprocessing.>

¹⁴<https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/glossary>

¹⁵<https://www.epa.gov/smm/sustainable-materials-management-non-hazardous-materials-and-waste-management-hierarchy>

¹⁶<https://portal.ct.gov/DEEP/Reduce-Reuse-Recycle/Reuse/Reuse-Main-Page>

¹⁷<https://pw.lacounty.gov/epd/rethinkla/reuse/reuse-what-is.aspx>

¹⁸<https://content.ces.ncsu.edu/before-you-recycle-choose-to-reuse>

¹⁹<https://www.clinton-county.org/363/Waste-Reduction-Reuse>

²⁰<https://lessismore.org/materials/30-reuse-tips/>

²¹<https://recyclemontana.org/what-is-recycling-and-why-recycle/>

Organization/Source	Definition
Recycle Ann Arbor	Reuse: “Use materials more than once.” ²²
European Environment Agency	Reusing products: “Using them again for their original purpose, hence retaining more of the products’ value, compared with, for example, recycling the product for raw materials.” ²³
EU Waste Framework Directive	Preparation for reuse “gives used products a second life before they become waste and includes practices such as cleaning, repairing or refurbishing products or their parts without other pre-processing.” ²⁴

²² <https://www.recycleannarbor.org/divisions/reuse-network>

²³ <https://www.eea.europa.eu/highlights/product-reuse-and-longer-lifespans>

²⁴ <http://hi4csr.com/en/blog/the-importance-of-waste-hierarchy-in-circular-economy/#:~:text=2.,parts%20without%20other%20pre%2Dprocessing.>

A 2.0 NAICS Codes

A full list of the NAICS codes used in this study and the broader category into which they are grouped is provided in **Error! Reference source not found.**Table 6. Also included are reuse weightings applied and a crosswalk to the 2022 NAICS codes.

Table 6: 2017 NAICS Codes used, crosswalk to 2022 NAICS codes, and reuse weightings

2017 NAICS Code	2017 NAICS Title (and specific piece of the 2017 industry that is contained in the 2022 industry)	2022 NAICS Code	2022 NAICS Title	Weight category	Weight %	Notes
326212	Tire Retreading	326212	Tire Retreading	1	100	
423140	Motor Vehicle Parts (Used) Merchant Wholesalers	423140	Motor Vehicle Parts (Used) Merchant Wholesalers	1	100	
423830	Industrial Machinery and Equipment Merchant Wholesalers	423830	Industrial Machinery and Equipment Merchant Wholesalers	1	100	Narrowed with word "Repair"
423850	Service Establishment Equipment and Supplies Merchant Wholesalers	423850	Service Establishment Equipment and Supplies Merchant Wholesalers	1	100	Narrowed with word "Repair"
441120	Used Car Dealers	441120	Used Car Dealers	1	100	Primary NAICS only
453310	Used Merchandise Stores	459510	Used Merchandise Retailers	1	100	
532210	Consumer Electronics and Appliances Rental	532210	Consumer Electronics and Appliances Rental	1	100	
532281	Formal Wear and Costume Rental	532281	Formal Wear and Costume Rental	1	100	
532282	Video Tape and Disc Rental	532282	Video Tape and Disc Rental	1	100	
532283	Home Health Equipment Rental	532283	Home Health Equipment Rental	1	100	
532289	All Other Consumer Goods Rental	532289	All Other Consumer Goods Rental	1	100	
532310	General Rental Centers	532310	General Rental Centers	1	100	

2017 NAICS Code	2017 NAICS Title (and specific piece of the 2017 industry that is contained in the 2022 industry)	2022 NAICS Code	2022 NAICS Title	Weight category	Weight %	Notes
811211	Consumer Electronics Repair and Maintenance	811210	Electronic and Precision Equipment Repair and Maintenance	1	100	
811212	Computer and Office Machine Repair and Maintenance	811210	Electronic and Precision Equipment Repair and Maintenance	1	100	
811213	Communication Equipment Repair and Maintenance	811210	Electronic and Precision Equipment Repair and Maintenance	1	100	
811219	Other Electronic and Precision Equipment Repair and Maintenance	811210	Electronic and Precision Equipment Repair and Maintenance	1	100	
811310	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	811310	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	1	100	
811411	Home and Garden Equipment Repair and Maintenance	811411	Home and Garden Equipment Repair and Maintenance	1	100	
811412	Appliance Repair and Maintenance	811412	Appliance Repair and Maintenance	1	100	
811420	Reupholstery and Furniture Repair	811420	Reupholstery and Furniture Repair	1	100	
811430	Footwear and Leather Goods Repair	811430	Footwear and Leather Goods Repair	1	100	
811490	Other Personal and Household Goods Repair and Maintenance	811490	Other Personal and Household Goods Repair and Maintenance	1	100	

2017 NAICS Code	2017 NAICS Title (and specific piece of the 2017 industry that is contained in the 2022 industry)	2022 NAICS Code	2022 NAICS Title	Weight category	Weight %	Notes
333244	Printing Machinery and Equipment Manufacturing	333248	All Other Industrial Machinery Manufacturing	2	60	Narrowed with word "Repair"
333249	Other Industrial Machinery Manufacturing	333248	All Other Industrial Machinery Manufacturing	2	60	Narrowed with word "Repair"
532120	Truck, Utility Trailer, and RV (Recreational Vehicle) Rental and Leasing	532120	Truck, Utility Trailer, and RV (Recreational Vehicle) Rental and Leasing	2	60	Narrowed with words "camper, van, RV"
532284	Recreational Goods Rental	532284	Recreational Goods Rental	2	60	
532420	Office Machinery and Equipment Rental and Leasing	532420	Office Machinery and Equipment Rental and Leasing	2	60	
532490	Other Commercial and Industrial Machinery and Equipment Rental and Leasing	532490	Other Commercial and Industrial Machinery and Equipment Rental and Leasing	2	60	
441210	Recreational Vehicle Dealers	441210	Recreational Vehicle Dealers	3	20	INCLUDES ALL - Used doesn't have its own number
441222	Boat Dealers	441222	Boat Dealers	3	20	INCLUDES ALL - Used doesn't have its own number
448110	Men's Clothing Stores	458110	Clothing and Clothing Accessories Retailers	3	20	BRIDAL ONLY - Narrowed

2017 NAICS Code	2017 NAICS Title (and specific piece of the 2017 industry that is contained in the 2022 industry)	2022 NAICS Code	2022 NAICS Title	Weight category	Weight %	Notes
						with word "Bridal"
448120	Women's Clothing Stores	458110	Clothing and Clothing Accessories Retailers	3	20	BRIDAL ONLY - Narrowed with word "Bridal"
448130	Children's and Infants' Clothing Stores	458110	Clothing and Clothing Accessories Retailers	3	20	BRIDAL ONLY - Narrowed with word "Bridal"
448140	Family Clothing Stores	458110	Clothing and Clothing Accessories Retailers	3	20	BRIDAL ONLY - Narrowed with word "Bridal"
448150	Clothing Accessories Stores	458110	Clothing and Clothing Accessories Retailers	3	20	BRIDAL ONLY - Narrowed with word "Bridal"
448190	Other Clothing Stores	458110	Clothing and Clothing Accessories Retailers	3	20	BRIDAL ONLY - Narrowed with word "Bridal"
451110	Sporting Goods Stores	459110	Sporting Goods Retailers	3	20	
451211	Book Stores	459210	Book Retailers and News Dealers	3	20	Removed publishers
532111	Passenger Car Rental	532111	Passenger Car Rental	4	5	
532112	Passenger Car Leasing	532112	Passenger Car Leasing	4	5	

A 3.0 GHG Sensitivity matrix

Table 7 provides a sensitivity matrix of the GHG emission savings, which shows the spread of possibilities based on the unknowns, based on various weightings (which are somewhat subjective) that could be applied as well as various emissions factors (which differed between the 2020 and 2022 studies).

Table 7: Sensitivity matrix of results

2020 study 'weighted' value

2022 USEEIO default value

2022 Carnegie Mellon default value

Values in table are in tCO2e		kgCO2e per \$ (Average)																							
		0.025	0.05	0.075	0.1	0.125	0.15	0.175	0.2	0.225	0.25	0.275	0.3	0.325	0.35	0.375	0.4	0.425	0.45	0.475	0.5	0.525	0.55	0.575	0.6
Reuse Weighting (Average)	5%	5,946	11,892	17,838	23,783	29,729	35,675	41,621	47,567	53,513	59,459	65,405	71,350	77,296	83,242	89,188	95,134	101,080	107,026	112,971	118,917	124,863	130,809	136,755	142,701
	10%	11,892	23,783	35,675	47,567	59,459	71,350	83,242	95,134	107,026	118,917	130,809	142,701	154,593	166,484	178,376	190,268	202,159	214,051	225,943	237,835	249,726	261,618	273,510	285,402
	15%	17,838	35,675	53,513	71,350	89,188	107,026	124,863	142,701	160,538	178,376	196,214	214,051	231,889	249,726	267,564	285,402	303,239	321,077	338,914	356,752	374,590	392,427	410,265	428,102
	20%	23,783	47,567	71,350	95,134	118,917	142,701	166,484	190,268	214,051	237,835	261,618	285,402	309,185	332,968	356,752	380,535	404,319	428,102	451,886	475,669	499,453	523,236	547,020	570,803
	25%	29,729	59,459	89,188	118,917	148,647	178,376	208,105	237,835	267,564	297,293	327,023	356,752	386,481	416,211	445,940	475,669	505,399	535,128	564,857	594,587	624,316	654,045	683,775	713,504
	30%	35,675	71,350	107,026	142,701	178,376	214,051	249,726	285,402	321,077	356,752	392,427	428,102	463,778	499,453	535,128	570,803	606,478	642,153	677,829	713,504	749,179	784,854	820,529	856,205
	35%	41,621	83,242	124,863	166,484	208,105	249,726	291,347	332,968	374,590	416,211	457,832	499,453	541,074	582,695	624,316	665,937	707,558	749,179	790,800	832,421	874,042	915,663	957,284	998,905
	40%	47,567	95,134	142,701	190,268	237,835	285,402	332,968	380,535	428,102	475,669	523,236	570,803	618,370	665,937	713,504	761,071	808,638	856,205	903,772	951,338	998,905	1,046,472	1,094,039	1,141,606
	45%	53,513	107,026	160,538	214,051	267,564	321,077	374,590	428,102	481,615	535,128	588,641	642,153	695,666	749,179	802,692	856,205	909,717	963,230	1,016,743	1,070,256	1,123,769	1,177,281	1,230,794	1,284,307
	50%	59,459	118,917	178,376	237,835	297,293	356,752	416,211	475,669	535,128	594,587	654,045	713,504	772,963	832,421	891,880	951,338	1,010,797	1,070,256	1,129,714	1,189,173	1,248,632	1,308,090	1,367,549	1,427,008
	55%	65,405	130,809	196,214	261,618	327,023	392,427	457,832	523,236	588,641	654,045	719,450	784,854	850,259	915,663	981,068	1,046,472	1,111,877	1,177,281	1,242,686	1,308,090	1,373,495	1,438,899	1,504,304	1,569,709
	60%	71,350	142,701	214,051	285,402	356,752	428,102	499,453	570,803	642,153	713,504	784,854	856,205	927,555	998,905	1,070,256	1,141,606	1,212,957	1,284,307	1,355,657	1,427,008	1,498,358	1,569,709	1,641,059	1,712,409
	65%	77,296	154,593	231,889	309,185	386,481	463,778	541,074	618,370	695,666	772,963	850,259	927,555	1,004,851	1,082,148	1,159,444	1,236,740	1,314,036	1,391,333	1,468,629	1,545,925	1,623,221	1,700,518	1,777,814	1,855,110
	70%	83,242	166,484	249,726	332,968	416,211	499,453	582,695	665,937	749,179	832,421	915,663	998,905	1,082,148	1,165,390	1,248,632	1,331,874	1,415,116	1,498,358	1,581,600	1,664,842	1,748,084	1,831,327	1,914,569	1,997,811
	75%	89,188	178,376	267,564	356,752	445,940	535,128	624,316	713,504	802,692	891,880	981,068	1,070,256	1,159,444	1,248,632	1,337,820	1,427,008	1,516,196	1,605,384	1,694,572	1,783,760	1,872,948	1,962,136	2,051,324	2,140,512
	80%	95,134	190,268	285,402	380,535	475,669	570,803	665,937	761,071	856,205	951,338	1,046,472	1,141,606	1,236,740	1,331,874	1,427,008	1,522,142	1,617,275	1,712,409	1,807,543	1,902,677	1,997,811	2,092,945	2,188,079	2,283,212
	85%	101,080	202,159	303,239	404,319	505,399	606,478	707,558	808,638	909,717	1,010,797	1,111,877	1,212,957	1,314,036	1,415,116	1,516,196	1,617,275	1,718,355	1,819,435	1,920,515	2,021,594	2,122,674	2,223,754	2,324,833	2,425,913
	90%	107,026	214,051	321,077	428,102	535,128	642,153	749,179	856,205	963,230	1,070,256	1,177,281	1,284,307	1,391,333	1,498,358	1,605,384	1,712,409	1,819,435	1,926,460	2,033,486	2,140,512	2,247,537	2,354,563	2,461,588	2,568,614
	95%	112,971	225,943	338,914	451,886	564,857	677,829	790,800	903,772	1,016,743	1,129,714	1,242,686	1,355,657	1,468,629	1,581,600	1,694,572	1,807,543	1,920,515	2,033,486	2,146,457	2,259,429	2,372,400	2,485,372	2,598,343	2,711,315
	100%	118,917	237,835	356,752	475,669	594,587	713,504	832,421	951,338	1,070,256	1,189,173	1,308,090	1,427,008	1,545,925	1,664,842	1,783,760	1,902,677	2,021,594	2,140,512	2,259,429	2,378,346	2,497,264	2,616,181	2,735,098	2,854,015

