



PREPARED BY:



# EXPANDING CAPACITY FOR WOODY BIOMASS PROCESSING IN THE TWIN CITIES METRO AREA

February 2025

PREPARED FOR:



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# Glossary of Terms and Acronyms

## Definition of Terms

- **District Energy & Affiliates:** A group of organizations consisting of District Energy St. Paul, Ever-Green Energy, St. Paul Cogeneration, and Environmental Wood Supply.
- **District Energy St. Paul (District Energy):** Nonprofit utility providing energy services to downtown Saint Paul.
- **Ever-Green Energy:** Provides operations and management services for District Energy operations. District Energy is the parent company to Ever-Green Energy.
- **Environmental Wood Supply:** An affiliate of District Energy developed by Ever-Green Energy to supply biomass fuel for St. Paul Cogeneration. Environmental Wood Supply operates the Pig's Eye Wood Recycling Center.
- **Partnership on Waste and Energy (Partnership):** Partnership on Waste & Energy is a joint powers group that includes Hennepin, Ramsey, and Washington Counties. Through the Partnership, the counties collaborate in areas of waste and energy management, including legislation and policy development, communication and outreach, and planning and evaluation of waste processing technologies.
- **Pig's Eye Wood Recycling Center:** A sort yard owned by the City of Saint Paul, located on City park land. Environmental Wood Supply operates the facility and invests all capital in buildings and equipment.
- **St. Paul Cogeneration:** A biomass-fired combined heat and power plant developed by Ever-Green Energy to improve the efficiency and environmental profile of District Energy.
- **Sort Yard:** A temporary location where logs, chips, and other woody biomass are sorted and processed before being delivered to utilization facilities.
- **Woody Biomass Generators:** Companies actively engaged in tree care and management activities (e.g. removals).
- **Woody Biomass Utilizers:** Businesses using wood in primary and secondary products (e.g., durable wood products, bioenergy, biochar, etc.).
- **Woody Biomass/Wood Waste:** Material consisting of brush, logs, chips, mulch
- **Yard Waste:** Material consisting of leaves, grass clippings, branches, and soft-bodied plants.

## Acronyms

AGRI	Agriculture, Growth, Research, and Innovation
BDO	Bioeconomy Development Opportunity
CDR	Carbon dioxide removal
CHP	Combined Heat and Power
DE	District Energy
EAB	Emerald Ash Borer
EQB	Environmental Quality Board
EWS	Environmental Wood Supply
GHG	Greenhouse gas
H2HH	Heartland Hydrogen Hub
MDA	Minnesota Department of Agriculture
MDNR	Minnesota Department of Natural Resources
MPCA	Minnesota Pollution Control Agency
MSP	Minneapolis-St. Paul
NGIA	Natural Gas Innovation Act
PPA	Power purchase agreement
PUC	Public Utilities Commission
RDF	Refuse-derived fuel
RFP	Request for proposal
SAF	Sustainable aviation fuel
SMSC	Shakopee Mdewakanton Sioux Community
SPC	St. Paul Cogeneration
TCMA	Twin Cities Metro area
USFS	United States Forest Service

# Executive Summary

The goal of this assessment is to provide an opportunity analysis for alternative and higher-use of wood waste for the Twin Cities metropolitan area. This report, prepared for the Partnership on Waste & Energy, seeks to effectively manage an increasing amount of wood waste from emerald ash borer and other generation activities, specifically within Hennepin, Ramsey, and Washington counties.

Over half a million tons of wood waste are generated in the Twin Cities metro area annually, and projections suggest that peak tree removal associated with emerald ash borer will not occur until 2028. District Energy's St. Paul Cogeneration is the largest utilizer of wood waste in the region, yet evolving state legislation and a myriad of operational challenges threaten the long-term consumption of woody biomass at this facility. As sort yard operators and other wood waste stakeholders struggle to manage the growing waste stream, opportunities exist to bolster existing outlets and develop new markets for wood.

Based on more than 25 stakeholder interviews and an evaluation of near- and long-term wood utilization opportunities, this report outlines the following recommendations:

- **Update wood waste and emerald ash borer projections to inform investment strategies.** Data from the MDA and EQB projecting the spread of EAB and wood waste volumes have not been updated since 2019, which projected a large range of when peak infestation is likely to occur. Additionally, current management systems at the state and local levels lack the ability to track annual wood waste volumes and characteristics. Refining these estimates would help to inform waste management strategies, investment in capital-intensive technologies, and pursuit of market enablers like BDO Zones.
- **Support woody biomass energy production through implementation of the Carbon-free Standard for electricity and future legislative efforts.** Cambium recommends approaching woody biomass energy production with consideration of net emissions and life-cycle assessments. The counterfactual of biomass utilization in the metro area is often open burning, an activity associated with significant environmental and public health effects. Similarly, District Energy and Koda Energy play outsized roles in woody biomass processing, and their ability to continue supporting wood waste management largely depends on the legislative outcome of the Carbon-free Standard for electricity.
- **Seek opportunities to develop new sort yards and diversify markets at existing sort yard locations.** The recent [Washington County RFP for Yard Waste Processing](#) offers a novel model for incentivizing the growth of various product markets. The Partnership should look for opportunities to leverage similar frameworks at existing sort yards, in addition to installing new facilities to increase processing capacity. Cambium recommends exploring the development of a “network” of sort yards, wherein multiple locations around the metro area are available for accepting material from generators and subsequently processing it for utilizers. Strategically locating these sort yards would

alleviate transportation costs for both generators and utilizers while maximizing the associated value of feedstock.

- **Support legislative initiatives to bolster existing state funding programs that offer support to both private organizations and municipalities.** The 2024 [MPCA Wood Utilization Grant](#) is a new, one-time program offering up to \$250,000 for projects in Minnesota looking to improve biomass utilization through energy production, soil amendments, carbon storage, durable wood products, and other projects that demonstrate benefits aligned with the Wood Waste Hierarchy. However, the \$1 million of total available funding through the program is widely seen as insufficient for addressing the scale of wood waste management challenges in the state. The Partnership should work to support establishment of on-going, more robustly funded grant programs.
- **Create mechanisms for collaboration across government agencies engaged in wood waste management.** A myriad of factors contribute to the effectiveness of management strategies, including the climate impact, economic efficiency, and the amount of material they manage. State agencies engaged in wood waste management may have competing priorities, hindering advancement of potential solutions. Cambium recommends seeking collaboration between groups such as the Partnership, MPCA, Department of Commerce, MDNR, MDA, and MN Forest Resources Council to advance policy and investment opportunities. For example, stronger partnership between these agencies offers an important set of relationships to inform the PUC decision making around the use of woody biomass used in electricity generation and fuel applications. Collaboration could be facilitated through existing state forums such as the Environmental Quality Board.
- **Analyze opportunities to pursue external grants and market enablers.** Funding sources such as the [USFS Wood Innovations Grant](#) and others outlined in **Table 6** could be pursued to help build offtake markets and partnerships with woody biomass utilizers. Evaluation of specific market forces in the Twin Cities metro area, as well as a deeper characterization of the region's wood waste stream, can help determine which funding opportunities to pursue.

# Introduction

Wood waste management continues to be a mounting issue in the Twin Cities Metro Area (TCMA). Woody biomass generation has grown with the spread of Emerald Ash Borer while capacity at existing wood waste outlets has largely stagnated, resulting in skyrocketing management costs. The Partnership on Waste and Energy (Partnership) for Hennepin, Ramsey, and Washington counties commissioned this report as a follow-up to Cambium's 2022 analysis in order to study woody biomass utilization pathways that could help alleviate the shortage of capacity for managing wood waste from the TCMA.

This report seeks to address the following questions, with a focus on the 3 partner counties:

- What are the near- and long-term opportunities to support the operation of District Energy's St. Paul Cogeneration facility and Environmental Wood Supply (EWS) sort yard?
- What is the potential, immediate or near-term uptake of woody biomass waste feedstock in the Twin Cities metro area?
- What are the opportunities for long-term uptake of woody biomass via bioenergy, soil amendments, durable wood products, and other emerging technologies? What are the policy and funding levers in place to help incentivize this uptake?
- How can wood waste utilization goals be met through development of county-level Solid Waste Management Plans?

This analysis was conducted by [Cambium](#), a public benefit corporation on a mission to enable a regenerative cycle of urban wood reuse. The company has worked with governments, NGOs, and private sector companies across the United States to develop programs, partnerships, and markets that enable wood utilization.

This project is commissioned by the [Partnership on Waste and Energy](#) (Partnership), a Joint Powers Board representing Hennepin, Ramsey and Washington counties, formed to address waste management and energy issues. The Partnership seeks to end waste, promote renewable energy and enhance the health and resiliency of the communities it serves while advancing equity and responding to the challenges of a changing climate.

We would also like to thank the more than 25 stakeholders who provided data and insights over the course of this analysis. This project could not have been completed without your support.

# Emerald Ash Borer in Minnesota and the Twin Cities Metro Area

As outlined in the Partnership's [wood waste study](#) prepared by Cambium and published in 2022, emerald ash borer (EAB) has continued to spread throughout Minnesota. Without low-cost treatment options and the prevalence of ash trees in unmanaged woodland areas, EAB remains a threat to nearly 1 billion trees in the state. The Minnesota Department of Agriculture (MDA) [expects 99 percent mortality over time](#), and it is predicted to cost municipalities \$30 million per year through 2050 for street tree removal and replacement.

State detection efforts have found a significantly faster rate of EAB spread than initially predicted. In their [2019 EAB Report](#), the MN Environmental Quality Board (EQB) projected that EAB would be present in about 25 counties in 2024. Under the worst-case scenario, this estimate was 40 counties. As of the writing of this report in November 2024, the MDA's [EAB Status Map](#) shows pest sightings in 53 counties, more than a 50 percent increase over the past 2 years.

An absence of comprehensive data on ash tree removals across public and private property makes projecting estimated wood waste volumes difficult at this time. In 2022, the MDA projected a statewide peak in ash tree removals to occur between 2024 and 2025 under a 12-year model, and between 2028 and 2029 under a 20-year model. Based on proxy data from a 2016 study<sup>1</sup> – as well as Minnesota's cold weather, which assists in slowing EAB spread – this study concluded that the 20-year model is a better fit in representing infestation trajectory. As EAB spreads, the status of municipal treatment and removal efforts has varied. The cities of Minneapolis and St. Paul [finished removing public ash trees in 2024](#), accounting for a loss of over 65,000 trees since EAB was first discovered in the area in 2009. Tens of thousands of ash trees remain on private property in Minneapolis, and the Minneapolis Park and Recreation Board is turning its focus toward condemning these trees. Meanwhile, St. Paul is directing its efforts toward removing around [11,000 ash trees remaining](#) on its woodland properties. The city also treats roughly 1,000 trees annually on public lands to prevent infestation of EAB.

Anecdotally, conversations with stakeholders suggest that the TCMA is generating over 550,000 tons of wood waste annually, with no expectation for this volume to decrease in the near-term. Similarly, woody biomass generators (e.g., local tree care companies, green waste processors, etc.) reported that the proportion of ash material in their work streams ranged from 50 percent to 90 percent, although these data are not tracked uniformly across the region.

Developing statewide and local data collection efforts will be critical for updating wood waste generation and EAB infestation estimates. As part of the [2022-2042 Solid Waste Management Policy Plan](#), the Minnesota Pollution Control Agency (MPCA) is requiring counties to begin

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<sup>1</sup> [Effects of emerald ash borer on municipal forestry budgets. Richard J. Hauer. Ward D. Peterson. 2016.](#)



regulating and tracking data related to wood waste generation and to develop wood waste management plans. In addition, previous projections from the EQB and MDA should be updated to provide a clearer picture of the challenges facing the state.

## Current Wood Waste Ecosystem

To understand the potential for expanding woody biomass processing and utilization in Hennepin, Ramsey, and Washington counties, Cambium Carbon conducted interviews with over 25 organizations involved in woody biomass management in the TCMA. Cambium reconnected with several stakeholders from the 2022 study, in addition to developers of nascent technologies, existing woody biomass processors, waste disposal companies, and government and policy advocates.

Identification of relevant stakeholders was supported by the Partnership and in collaboration with the MPCA's newly-formed wood waste stakeholder group. We also spoke with several statewide and national organizations to understand the status of technologies not currently present in the TCMA.

The goal of these interviews was to understand how wood waste management challenges have evolved over the past 2 years, and explore the potential for new capacity in the woody biomass utilization and processing ecosystem. Engaging with organizations outside of the TCMA provided additional insights into potential future investments in beneficial biomass utilization.

A summary of Cambium’s stakeholder interviews is provided in the figure below. A more detailed stakeholder list can be found in the [Appendix](#).

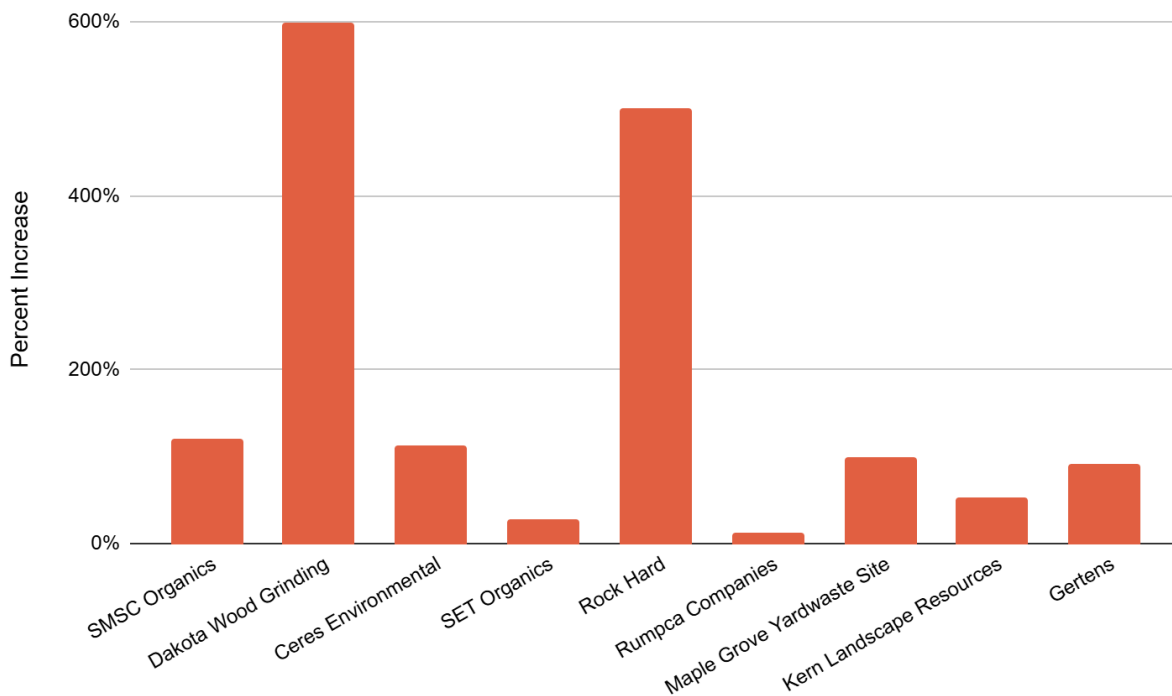


**Figure 1. Summary of Cambium’s Stakeholder Interviews**

## Woody Biomass Generator Perspective

Woody biomass generators consistently highlighted the rising costs of disposal and processing as a major challenge to their operations. Specifically, tipping fees for commercial wood drop-offs have skyrocketed and hindered the ability for private and public generators to find affordable outlets for their material. Across nine organizations accepting commercial wood waste in the metro area, tipping fees have increased by an average of 180 percent since 2022. Similarly, contracts to process and haul woody biomass in some counties has increased nearly fivefold over the same time period.

**Figure 2** below provides detail on the rise of tipping fees across the metro area.



**Figure 2.** Percent increase in tipping fees at various wood processing sites around the Twin Cities between 2022 and 2024.

Generators experiencing increased wood volumes also highlighted the shortage and unreliability of existing disposal options. With few outlets around the TCMA accepting wood waste, large transportation distances between available sites significantly increases hauling costs. In addition, the rise in material being brought to existing outlets has challenged their ability to stay open to the public on a regular basis. [Dakota Wood Grinding](#), a wood grinding company based in Rosemount, MN that processes over 500,000 tons of wood annually, closed to drop-offs for over half of 2024. Other disposal options like Gertens and Rock Hard have managed to avoid temporary closures, but acknowledge that the current saturation is making it exceedingly difficult to do so.

Increased tipping fees and challenges staying open have occurred at disposal outlets across the TCMA, but managers of these yards highlight that their decisions are largely informed by changes at Environmental Wood Supply (EWS),<sup>2</sup> historically the largest outlet for wood waste in the region. As discussed in the 2022 study, EWS processes roughly 220,000 tons of wood waste annually in the form of mulch, chips, brush, and logs at the Pig's Eye Wood Recycling Center.<sup>3</sup> In addition to accepting commercial waste drop-offs, EWS also offers hauling services for partners throughout the metro area. Other disposal outlets have relied on EWS as an important backstop when their own yards are full.

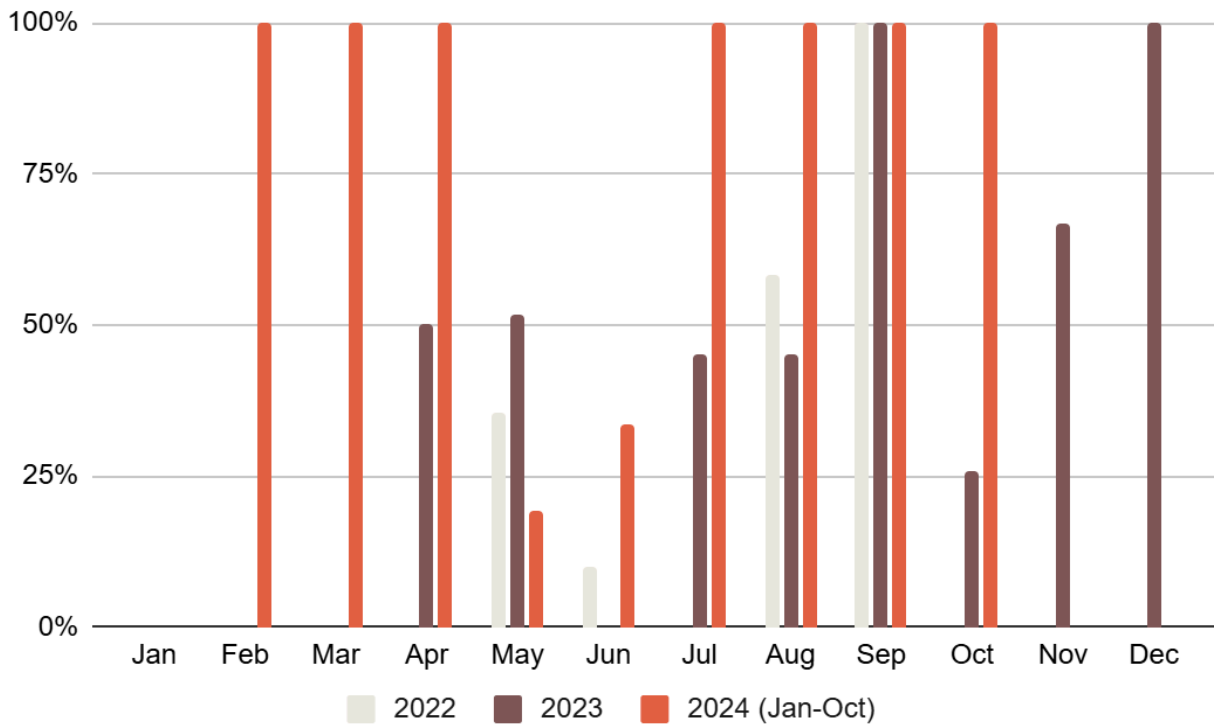
Over the past several years, EWS has steadily increased the number of days it has closed for wood drop-offs, citing capacity limitations. Additionally, EWS has nearly tripled its costs for picking up material from county partners and charges inconsistently for commercial drop-offs. When woody biomass generators are forced to turn to other disposal options in the TCMA, these outlets describe “lines out the door all day” and have had no option but to raise their tipping fees.

**Figure 3** below illustrates the percent of days EWS was closed for brush and log drop-offs between 2022 and 2024, equating to roughly 17 percent of 2022, 41 percent of 2023, and projected to be at least 70 percent of 2024.

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<sup>2</sup> EWS is an affiliate of District Energy St. Paul that collects and processes regional wood waste into biomass for use at St. Paul Cogeneration, a combined heat and power plant.

<sup>3</sup> The Pig's Eye Wood Recycling Center is owned by the City of Saint Paul and operated on contract by EWS for biomass processing.



**Figure 3.** Percent of days EWS was closed by month, 2022 through August, 2024. Data provided by Chris Peterson at District Energy.

With capacity and reliability challenges at existing disposal outlets, woody biomass generators have called for the need to develop more wood yards in the region. Stakeholders have noted there are several major tree care companies around the TCMA that could support the installation of these sites, in effect creating a “network” of yards to increase efficiency of material flow and decrease the transportation burden on generators. The details of how this strategy could be developed will be explored in later sections.

## Challenges at District Energy and Affiliates

While wood waste generators and disposal outlets highlighted the importance of EWS to their own operations, these companies also expressed confusion about the wood yard’s management decisions. Stakeholders responded that EWS often gives short notice as to when their wood yard will be offline, and their changes to drop-off and hauling fees are unpredictable. Similarly, policymakers struggle to understand the specific challenges that District Energy and its affiliates are facing, hindering their ability to support relieving these issues.

In interviews with District Energy, staff members underscored the explosion of material being brought to the Pig’s Eye Wood Recycling Center and the limited capacity of St. Paul Cogeneration (SPC) as major barriers to processing more biomass. SPC can consume roughly

250,000 tons of woody biomass annually, a capacity which has consistently been reached in recent years. EWS can store approximately 35 to 45 days of woody biomass fuel at the Pig's Eye Wood Recycling Center, a safety limit that is frequently hit during the spread of EAB. Given space and processing constraints of Pig's Eye, EWS increasingly is closed to logs and brush drop-offs before mulch and chips.

The location of the Pig's Eye Wood Recycling Center also presents challenges to EWS' and SPC's consistent operation. The land is adjacent to Battle Creek and Pig's Eye Lake, a wetland area that floods frequently and requires EWS to shut down. According to the [Pig's Eye Dump Task Force 2024 Annual Report](#), major flooding is estimated to occur here every two years.

In addition to flooding risks that impact EWS' ability to operate at the Pig's Eye Recycling Center, recent efforts for landfill remediation at the adjacent Pig's Eye Dump may challenge the Center's long-term operations. The [Pig's Eye Dump Task Force](#) is currently developing remediation strategies and restoration plans for the site, with a final report due to the Minnesota Legislature by 2026. Remediation work is several years away, and District Energy does not foresee a near-term impact to EWS' work. However, Ken Smith, Senior Advisor to the Board of Directors at District Energy, acknowledged that there will likely be an effect at some point, although to what extent is unclear at this time. Due to this uncertainty, along with the current capacity challenges, District Energy has additional storage sites around the TCMA.

To address these challenges in the near-term, District Energy has expressed interest in developing additional wood marshaling yards to store wood waste for a longer period of time and minimize operational risks of flooding. This would allow EWS to store bulkier material – which typically degrades at a slower rate – off-site, and increase their ability to take mulch on-site. However, stakeholders note that while this may result in more processed biomass, the amount utilized is still limited by the 250,000 tons annual capacity at SPC,

Long-term, several factors present uncertainty in District Energy's ability to support wood waste processing at EWS and wood consumption at SPC. As noted in the 2022 study, [Xcel Energy](#), a national public utility based in Minnesota, holds a power purchase agreement (PPA) with SPC for renewable electricity. In the absence of this PPA, Smith does not currently see a path forward for the continued use of woody biomass at the facility.

The Minnesota Public Utilities Commission (PUC) recently awarded Xcel Energy an extended PPA with SPC through May 31, 2028. However, this agreement is three years shorter than requested, creating additional uncertainty for SPC's future operations. In their decision, the PUC requires that Xcel file a request to extend the PPA on or before August 1, 2027, in order to provide stakeholders an opportunity in the interim to explore the implementation of a tipping fee at EWS. The ability to increase revenue at SPC through financial structures like tipping fees will be critical for extension of the PPA past 2028.<sup>4</sup>

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<sup>4</sup> Docket No. E-002/M-21-590, Order Approving Electrification Proposal and Extension of Power Purchase Agreement. Issue date: November 4, 2024.

Continued funding through an MPCA grant is also contingent on District Energy's ability to implement tipping fees. SPC currently receives a subsidy of \$25 per ton of biomass consumed, with funding available through 2027. However, state officials shared that the grant agreement with District Energy withholds the final 10 percent of the grant award (equivalent to \$1.6 million) unless a tipping fee is installed. Ken Smith noted that withheld funds are less critical for continued operation of SPC than the PPA, but it indicates increasing pressure being placed on District Energy to improve the financial viability.

As tipping fees become an increasingly critical component to District Energy's operations, Smith acknowledges that the organization will need to implement them in the coming years. The topic of tipping fees for District Energy is further complicated by a lack of space and flooding risk at Pig's Eye, which causes the yard to shut down with increasing frequency. In addition, with costs for processing biomass skyrocketing, it may prove difficult to reach consensus on the pricepoint for a tipping fee.

The statewide transition to shift energy technologies to electrification, including for thermal energy needs, may eventually affect District Energy's use of wood biomass at SPC. District Energy from consuming woody biomass at SPC. In conjunction with the recent approval of the PPA between Xcel Energy and SPC, the PUC approved a project to install an electric boiler fueled by renewable electricity to displace the use of natural gas at SPC. While this project does not have direct implications for the facility's use of wood waste, it may indicate the beginning of a shift toward lower-emission energy sources. Smith similarly stressed that wood waste does not have an indefinite future at SPC.

Ongoing debates at the state-level around the definition of carbon-free electricity will have major implications for SPC's use of woody biomass. In 2023, Minnesota passed the Carbon-free Standard for electricity under [Statute §216B.1691](#), requiring that 80% of electricity supplied by utilities be carbon-free by 2030 and 100% by 2040. Regulatory efforts are ongoing to precisely define how wood fits under the "carbon-free" definition, with current discussions centered around "partial compliance" and the consideration of net emissions via life-cycle assessments.

Despite the array of challenges confronting District Energy, Ken Smith acknowledges that his organization currently plays a crucial role in wood waste management. He envisions a future where a diversification of wood outlets across the metro area further strengthens the system and eventually decreases reliance on SPC and EWS.

## Capacity Expansions in Progress

With uncertainty at EWS and limited capacity at other disposal outlets in the TCMA, the majority of stakeholders indicated a need to increase woody biomass utilization. There are several public and private projects underway that could potentially help deal with the wood waste issue. Many

of these were discussed in the 2022 study, but were either delayed or the amount of material expected to be processed has changed.

- [SMSC/Dakota Prairie Organics Recycling Facility](#) is a compost, natural fertilizer, and mulch producer owned and operated by the Shakopee Mdewakanton Sioux Community (SMSC). SMSC was targeting an expansion of ~20,000 tons of wood waste by the end of 2023, but this facility is now expected to open in Spring 2025.
- [Koda Energy](#) is a combined heat and power plant owned by the Rahr Corporation, currently consuming roughly 45,000 tons per year of woody biomass for electricity and thermal energy generation for Rahr's malting facility and part of the southwestern metro area. As of the 2022 study, Koda Energy had plans to commission a wood dryer by December 2023 to increase its on-site woody biomass processing capacity by up to 40,000 tons per year. Construction of this system has yet to begin as of December 2024, and Koda's current plans are to have the system operating by the end of 2025.
- The [City of Minneapolis](#) has begun construction on a stationary biochar unit, which is expected to be operational by the beginning of 2025. This system will process roughly 3,600 tons of woody biomass annually, lower than the 10,000 tons initially projected in the 2022 study but it will have the option to add additional processing units to increase throughput. The system is also designed to be primarily self-heated by recycling gases given off by the wood.
- [Recycling & Energy](#) is a partnership between Ramsey and Washington counties focused on responsible waste management. They have partnered with Dem-Con HZI Bioenergy to build an anaerobic digester that will process 75,000 tons of organic waste each year, of which 10,000 tons is expected to consist of wood and yard waste. The system has a projected start date of 2027.
- Washington County released a [request for proposal](#) in October 2024 to secure services for processing brush and wood waste to its highest and best use. The County handles roughly 7,000 tons of brush and wood waste annually, and is seeking 5-year contracts with companies to process its material into products such as lumber, firewood, mulch, and biochar. Selection of these contracts and a search for an additional public disposal facility is currently underway at the time of this writing. Staff estimate an additional facility and processing partnerships would allow for at least 7,000 additional tons of annual wood waste disposal capacity.
- [Xcel Energy](#) operates three refuse-derived fuel (RDF) plants in the region, which have the capacity to take on about 20,000 tons of additional woody biomass annually. However, this material will likely only be accepted in the fall and winter months when the facilities' supply of RDF tends to be lower. One of Xcel's RDF suppliers in North Mankato, [LJP Enterprises](#), is also looking to source roughly 5,000 tons of woody biomass.
- [Vonco](#) operates a recycling and waste management campus in Becker, Minnesota. The campus is currently developing a compost facility that will accept approximately 10,000 tons of wood and yard waste annually.



Cumulatively, these projects are estimated to increase the amount of woody biomass processed in the TCMA by approximately 115,000 tons per year. While significant, this is not sufficient to process the roughly 500,000 tons per year of wood waste being generated in the region. In addition, the delays and setbacks many of projects above have experienced underscores the need to support a diverse suite of expansion opportunities.

To enable woody biomass utilization beyond these ongoing initiatives, there are a range of established and nascent technologies that could be developed in the metro area, each presenting a unique set of challenges and opportunities. Evaluation of these various solutions will be explored in later sections.

## Impact of Mismanaged Material

The potentially large investment that increasing wood utilization capacity will require necessitates a deeper evaluation of costs associated with the business-as-usual scenario. Shared within stakeholder interviews, wood waste generators indicate that they have begun burning woody biomass for which they can't find an outlet.<sup>5</sup> In addition, [large piles of woody biomass](#) scattered throughout the metro area present the risk of self-starting, especially when the state experiences drought conditions.

Open burning of woody biomass has significant environmental, safety, and human health impacts. Smoke from wood burning contains fine particulate matter that can increase the risk of asthma attacks and respiratory infections, and can damage lung tissue in high concentrations. In Minnesota, roughly [57% of direct fine particulate emissions](#) are the result of wood burning. Wood smoke also contains criteria pollutants such as carbon monoxide, lead, nitrogen dioxide, ozone, and sulfur dioxide.

Despite the range of operational challenges District Energy is experiencing, roughly 250,000 tons per year of wood waste would need alternative disposal in the event that SPC shuts down. In deliberations with the Public Utilities Commission, Xcel Energy estimated that the termination of the power purchase agreement with SPC would have a societal cost of \$694 million (net present value, 2025-2050), largely due to criteria pollutant emissions resulting from open burning. Similarly, a recent net benefit test prepared by Xcel Energy, with input from the MPCA and District Energy, demonstrates a net benefit of the power purchase agreement to the state of [approximately \\$35 - \\$40 million annually](#).

Data on the alternative disposal fate of woody biomass are scarce; to inform future policy and investment decisions, Cambium recommends investing in research to understand the scale of open burning that is currently taking place. State agencies are weighing restrictions on open burning in the TCMA, yet without additional management outlets the activity is likely to continue.

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<sup>5</sup> The Minnesota Department of Natural Resources currently allows open burning with acquisition of [burning permits](#).

While open burning of woody biomass presents a clear harm to the region, alternative utilization options offer a more nuanced set of impacts. Current guidance from the MPCA on optimal wood utilization strategies, also known as the Wood Waste Hierarchy, is illustrated in **Figure 4**. The hierarchy ranks the relative preferability of tree preservation, durable wood products, soil amendments, bioenergy, and disposal, primarily influenced by life-cycle assessments and carbon sequestration totals. MPCA staff caution that this is fluid guidance that is subject to change as the science and data availability improves.



**Figure 4.** Illustration of MPCA Wood Waste Hierarchy (Draft visual shared November 2024)

## Opportunities for Increasing Wood Utilization

Over the course of this study, the stakeholders in **Figure 1** were interviewed to determine tangible near-term opportunities for increasing woody biomass utilization, defined as achievable

within a two-year timeframe. These strategies are highlighted as objective information-gathering and are not an endorsement of specific solutions.

In addition, an analysis of wood-utilization opportunities in nascent markets and industries outside of the TCMA was undertaken. This was supported through conversations with industry experts and policy advocates.

Special thanks to the Partnership's Policy Team for providing their insight on the legislative implications of various utilization opportunities.

## Durable Wood Products

### Lumber Production

The production of dimensional lumber, building materials, and other wood products via sawmills offers a conventional and high carbon sequestration opportunity for wood utilization. However, logs sourced from an urban environment often require mills to take the additional step of metal detection. Despite efforts to avoid contaminant metal, blades may be frequently damaged by embedded objects, increasing cost and slowing processing. This type of metal contamination – in addition to the heterogeneity of species and a lack of uniform growth patterns – is often cited by traditional sawmills as a barrier to utilizing urban lumber.

Several sawmills were approached over the course of this study to gauge their interest in adopting urban wood. [Sappi's Cloquet Mill](#), a pulp mill producing dissolved pulp for the textile market and bleached kraft pulp used in papermaking, indicated they are not looking for alternative sources of wood. In addition, Cambium reached out to roughly [25 sawmills and dry kiln companies](#) in the metro area yet no responses were received, reflecting a lack of interest in urban wood. However, pending responses and contracts that may result from Washington County's wood waste management RFP may further inform developments in this industry.

As noted in the 2022 study, [Wood from the Hood](#) is a hyper-local supplier of reclaimed urban wood from the Twin Cities, transforming fallen trees into dimensional lumber, slabs, tables, and other artisanal wood products. Wood from the Hood is currently scaling their operations to process 600 tons of tree waste annually with the support of a \$24,000 grant from the Partnership.<sup>6</sup>

### **Potential near-term strategy: Partnering with a major wood pallet producer in the region**

[Savanna Pallets](#), a major producer of wood pallets, skids, and crating in northern Minnesota, expressed a potential interest in sourcing wood from the metro area. The company primarily procures wood from forestry-driven activities within a 60-mile radius of their facilities, processing approximately 100,000 cords of timber and paying roughly \$135 per cord.

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<sup>6</sup> [Partnership on Waste & Energy Board Minutes. May 26, 2022.](#)

In conversations with Savanna Pallets regarding the viability of sourcing urban wood, staff underscored the importance of having a consistent feedstock - both in quantity and quality. Even though the company's processes are designed to handle feedstock variability, consistency of species type and diameters, among other characteristics, would allow for efficient processing. Longer-term sourcing agreements would also be dependent on the consistent supply of feedstock from the TCMA.

Staff at Savanna Pallets note that transportation costs would need to be optimized since trucking costs between northern Minnesota and the TCMA may be prohibitive. To work out these challenges however, Savanna Pallets is potentially open to small-scale pilots (e.g., supplying a couple of loads a week through a backhaul arrangement) that could be undertaken on an experimental basis.

Development of the lumber product industry's use of urban wood may be encouraged by [Minnesota's recycling goals](#), which state that by 2030 each county in the metro area aims to recycle 75 percent by weight of their total solid waste generation. Wood waste turned into mulch, composted, or processed into products such as dimensional lumber can be counted towards the recycling goal.<sup>7</sup>

## Carbon Dioxide Removal Projects

[Carbon dioxide removal \(CDR\)](#) refers to a range of technologies, practices, approaches that remove and durably store carbon dioxide from the atmosphere, such as direct air capture, afforestation/reforestation, and soil carbon sequestration. Development of CDR technologies has [grown rapidly in recent years](#), receiving billions of dollars in public support and hundreds of millions of dollars in private spending. CDR ventures may be heavily dependent on carbon markets as a financial mechanism for further scale-up.

### **Potential near-term strategy: Partnering with a local start-up using wood waste in CDR projects**

[Carba](#) is a start-up in the TCMA developing a CDR technology using torrefaction, a thermochemical process that decomposes biomass into an inert char that is buried underground to store carbon for over 1,000 years. Carba's proprietary reactor is a modular system that is designed to handle a variety of biomass feedstocks.

Carba is currently operating a prototype reactor at the [Burnsville Sanitary Landfill](#), where [Specialized Environmental Technologies](#) takes in a large amount of wood waste. A single reactor is currently capable of processing 15,000 tons of biomass annually, and Carba has plans of adding multiple reactors to the landfill location. In addition to this partnership, Carba is

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<sup>7</sup> 2024 Minnesota Statute 115A.551

working on a pilot with the Minnesota Department of Transportation and the City of St. Paul to blend their char product into asphalt, using trees from the local area.

Supporting the growth of businesses like Carba may offer a near-term opportunity to scale-up biomass utilization in the TCMA. Andrew Jones, CEO and Founder of Carba, noted that he is interested in pursuing long-term feedstock agreements and continuing his partnerships using municipal waste streams. While Carba is currently getting paid to take woody biomass, Jones acknowledges that there will be costs associated with biomass procurement, and has folded this into his business model.

From a regulatory perspective, the opportunity to expand use of carbon sequestration technologies in partnership with municipalities may require further clarification from state administrative agencies. For example, utilization of Carba’s torrefied char may depend on whether the material is considered a process waste or product. Stakeholders have also noted that Carba is currently using its char as daily cover at the Burnsville Landfill, but plans to bury this material may come with further restrictions.

## Soil Amendments

### Biochar

Biochar is a carbon-rich charcoal derived from pyrolysis of organic material in a low-oxygen environment. Biochar has been proven to sequester carbon as well as improve soil and plant health when reincorporated into landscapes; as a result, its production from wood waste is considered an opportunity for carbon offsetting as well as the derivation of a value-added product with benefits to soil health.

Modular biochar units offer a near-term solution for utilizing wood waste, and they can be moved to various locations depending on dynamic needs of the wood waste system. **Table 1** presents a non-exhaustive list of “turn-key” modular biochar units.

**Table 1:** “Turn-Key” Modular Biochar Units.<sup>a</sup>

Model	Amount Processed (tons/year) <sup>b</sup>	Amount Biochar Produced (cubic yards/year) <sup>b</sup>	Equipment Cost <sup>c</sup>	Cost per Ton Processed <sup>d</sup>
Tigercat (Carbonator)	42,000 - 84,000	31,000-62,000	\$750,000	\$9 - \$18
Air Burners (CharBoss)	2,100-4,200	840	\$150,000	\$36 - \$71
ARTi Biochar	5,250	9,660	\$250,000	\$48

Model	Amount Processed (tons/year) <sup>b</sup>	Amount Biochar Produced (cubic yards/year) <sup>b</sup>	Equipment Cost <sup>c</sup>	Cost per Ton Processed <sup>d</sup>
B-1000 (Biochar Solutions)	4,200	4,200-8,400	\$400,000	\$95
Takavator 100/1000 (Takachar)	460 - 4,600	30-50 kg/hour to 250 - 600 kg/hour	\$35,000 - \$150,000	\$33 - \$76
Chartainer (All Power Labs)	1,176	1,680	\$150,000 - \$200,000	\$128 - \$170

<sup>a</sup> Adapted from the [Mobile/Modular Wood Processing Technologies](#) fact sheet, compiled and maintained by Martin Twer, Biomass Program Director of the Watershed Center.

<sup>b</sup> Assuming operation of 12-hour/day, 350 days/year

<sup>c</sup> Does not include fuel or operating costs

<sup>d</sup> Cost per ton was estimated by dividing the upfront equipment cost from the amount of woody biomass processed in a single year.

**Potential near-term strategy: Purchasing a “turn-key” modular biochar unit (e.g., air curtain burner) for use at an existing wood yard**

There are no known state statutes or rules preventing the operation of modular biochar units in the TCMA, but there may be zoning and permitting restrictions based on the operation of a wood waste processing facility and level of emissions. In addition, there may be local resistance depending on the location and scale of the operation.

**Mulch and Compost**

Several mulch and compost producers in the region were engaged over the course of this study, but few near-term opportunities were identified for increasing utilization of wood waste.

Landscape mulch offers a relatively low-value but high-volume offtake market. However, as noted in the 2022 study and reconfirmed during the course of this report, mulch markets continue to be saturated in the TCMA. One tree care company noted there may be potential to ship material to markets outside of the region, but high transportation costs and the emissions associated with this strategy may make it undesirable.

Scaling wood waste use in compost also remains limited, as woody biomass is typically a proportionally small component (10-20%) of the compost waste stream to keep the carbon-to-nitrogen ratio constant. Future opportunities could emerge under Minnesota’s recent \$200 million [Climate-Smart Food Systems](#) grant from the EPA which includes \$60 million dedicated to innovations in food and organic material processing. Further research is needed to explore how wood waste could contribute to initiatives funded by this grant.

If new opportunities emerge, there are minimal legislative or policy obstacles to expanding these markets, and such efforts would align with statutory recycling goals for counties.

## Bioenergy

### Energy Recovery Systems

Energy recovery systems are a range of established technologies for generating heat and electricity from organic matter. District Energy and Koda Energy operate two major combined heat and power plants in the TCMA, with a potential to process a combined 335,000 tons of woody biomass. However, outside of the planned upgrades at Koda Energy discussed above, these facilities are currently at capacity and offer minimal opportunities for increased biomass utilization.

#### Potential near-term strategy: Purchasing a “turn-key” energy recovery unit for campus heating and power

Looking beyond these two key organizations to increase capacity, there are several modular energy recovery units available on the market, which offer energy production on a campus- or facility-level, and can be moved to various locations depending on dynamic needs. Many of these units also produce varying amounts of biochar as a byproduct, which could provide an additional source of revenue.

**Table 2** presents a non-exhaustive list of “turn-key” modular energy recovery units that specifically use woody biomass as a feedstock. There are no known units in operation in the metro area at this time.

**Table 2.** “Turn-Key” Modular Energy Recovery Units<sup>a</sup>

Model	Amount Processed (tons/year) <sup>b</sup>	Amount Energy Produced (kW) <sup>b</sup>	Equipment Cost <sup>c</sup>	Cost per Ton Processed <sup>d</sup>
PG FireBox (AirBurners)	29,400 - 54,600	100 - 1000 kW	\$830,000 - \$4,200,000	\$28 - \$76
Power Pallet (All Power Labs)	120	25-50 kW electric, 50-100 kW thermal	\$65,000	\$560
Power Pallet Hybrid Container (All Power Labs)	1,200	250 kW electric, 500 kW thermal	\$300,000	\$260

<sup>a</sup> Adapted from the [Mobile/Modular Wood Processing Technologies](#) fact sheet, compiled and maintained by Martin Twer, Biomass Program Director of the Watershed Center.

<sup>b</sup> Assuming operation of 12-hour/day, 350 days/year

<sup>c</sup> Does not include fuel or operating costs

<sup>d</sup> Cost per ton was estimated by dividing the upfront equipment cost from the amount of woody biomass processed in a single year.

While state statutes and regulations may allow operation of certain modular energy recovery units in the TCMA, the outcome of the Carbon-free Standard for electricity legislation could influence the feasibility of this approach. Additionally, the use of incineration as a waste management strategy may face substantial public opposition, along with potential zoning and permitting challenges, particularly concerning project size and air emissions.

### **Potential near-term strategy: Supplying woody biomass to refuse-derived fuel plants**

Refuse-derived fuel (RDF) is another energy recovery technology, produced from various types of waste, including municipal solid waste, paper and cardboard, textiles, and wood. RDF largely consists of the combustible components of waste, which are sorted via multiple processing steps to form a homogenous material which can be used as an alternative to fossil fuels.

[Xcel Energy](#) operates three refuse-derived fuel (RDF) plants within about 130 miles of the metro area, and taken together consume roughly 500,000 tons of RDF annually. These plants - located in Red Wing, MN, Mankato, MN and French Island, WI - were slated for retirement in 2027, but Xcel extended their decommission dates to 2037, 2037, and 2040, respectively.

Stakeholders have reported that Xcel is exploring the use of wood waste as fuel for its facilities, particularly during the fall and winter months when the supply of RDF is limited. Under one example, the City of Red Wing provides approximately 2,000 tons of wood waste annually to Xcel's Red Wing RDF plant at a cost of \$10 per ton. However, details about the volume of biomass Xcel aims to procure and the associated price remain unclear.

One RDF supplier to Xcel Energy, LJP Enterprises, also mentioned that they are looking to increase their production capacity of RDF by about 40,000 to 50,000 tons, of which 10 per could be composed of woody biomass and other organic material. The tipping fee at LJP Enterprises for this material is \$140 per ton.

Regulatory uncertainties remain in regards to the viability of recovering energy from wood and municipal solid waste at the same facility.<sup>8</sup> In addition, the use of RDF may be impacted by regulatory efforts to define how energy recovery from woody biomass is accounted for under the “carbon-free” definition of Carbon-free Standard.

Regulatory efforts are ongoing to precisely define how wood fits under the “carbon-free” definition, with current discussions centered around “partial compliance” and the consideration of net emissions via life-cycle assessments.

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<sup>8</sup> 2024 Minnesota Statute 115A.931



## Sustainable Aviation Fuel

Sustainable aviation fuel (SAF) is an alternative fuel made from non-petroleum feedstocks, such as municipal solid waste, woody biomass, and agricultural byproducts, that reduces emissions from air transportation. SAF can currently be blended with conventional jet fuel up to 50 percent, depending on the feedstock and the process. The aviation industry has a goal of producing [3 billion gallons of SAF annually by 2030](#), and to meet 100 percent of its fuel demand (roughly 35 billion gallons) with SAF by 2050.

Production of SAF from woody biomass typically begins with a process known as [gasification](#), where the feedstock is converted to carbon monoxide and hydrogen using high temperatures (>700°C) and a limited amount of oxygen. This blend, also known as syngas, is then converted to SAF using an established catalytic chemical process called the [Fischer-Tropsch \(FT\) synthesis](#). There are several projects around the country developing technologies to produce SAF from woody biomass, yet few are commercially operational.

The [Minnesota SAF Hub](#), a coalition between the GREATER MSP Partnership, Bank of America, Delta Airlines, Ecolab, and Xcel Energy, is supporting efforts to develop SAF production for delivery to Minneapolis-Saint Paul (MSP) International Airport. The SAF Hub has a near-term goal of displacing 10% of Delta's conventional jet fuel consumption at MSP International Airport by 2027, and 50% by 2035. There are several projects underway to support the coalition's goals, including:

- [Delta and Flint Resources](#) are in development of a facility to blend up to 30 million gallons of SAF at Flint's Pine Bend refinery in Rosemount, Minnesota. Shell will supply SAF, which the refinery will blend into its existing pipeline to MSP. The facility is expected to be completed in late 2025.
- In November 2024, [DG Fuels](#) announced the selection of a \$5 billion site in Moorhead, Minnesota, that will produce 193 million gallons annually of SAF using agricultural and wood waste as feedstocks. This amount represents nearly half of the fuel used at MSP International Airport, and production is expected to begin in 2030.
- [Comstock Fuels](#) is developing a proprietary technology to convert lignocellulosic biomass (i.e., corn stover and woody biomass) to syngas, which the company plans on providing to refineries for further processing to SAF. Comstock currently operates an R&D facility in Wausau, Wisconsin, and is looking to site a pilot production plant in Minnesota.

Facilities producing SAF and their intermediates tend to be very large, processing at least 100,000 bone dry tons of biomass annually. Stakeholders highlighted that with the large capital requirements associated with SAF projects, co-locating a facility with the processing of feedstock is an important factor for improving the economic outlook. Similarly, it is much more economical to transport the refined end products or their intermediates, as opposed to the

biomass itself. Taking advantage of existing infrastructure and marketing the co-products are two opportunities to make the development of SAF projects more favorable.

To meet ambitious SAF production goals, there are several state and federal incentives available. However, access to federal funding is uncertain under the evolving political landscape.

- **Inflationary Reduction Act Sustainable Aviation Fuel Tax Credit.** Producers of SAF are eligible for a tax credit between \$1.25 and \$1.75 per gallon that achieves GHG emissions reduction of at least 50% compared to petroleum-based jet fuel. SAF that decreases GHG emissions by more than 50% is eligible for an additional \$0.01 per gallon for each percent the reduction exceeds 50%, up to \$0.50 per gallon. This credit is expected to expire on January 1, 2025.
- **Minnesota Sustainable Aviation Fuel Credit.** This state-based credit provides \$1.50 for each gallon of SAF that is produced or sold within Minnesota, and that achieves a greenhouse gas emissions reduction of at least 50%. The credit is available for SAF sold after June 30, 2024 and before July 1, 2030.
- **Clean Fuel Production Credit.** Also known as Section 45Z, this credit incentivizes the production and sale of low emission transportation fuels. The tax credit amount is \$0.20 per gallon for non-aviation fuel and \$0.35 per gallon for SAF, with increased amounts available for producers that meet certain [prevailing wage and apprenticeship requirements](#). This credit will be available beginning January 1, 2025.

## Hydrogen

Hydrogen is a major feedstock in the petroleum refining and ammonia industries, with approximately 10 million metric tons of the chemical produced in the United States annually. There are several emerging markets for hydrogen, particularly in industries looking to decarbonize their processes, such as data centers, steel manufacturing and transportation.

Hydrogen can be synthesized from a variety of technologies and feedstocks, ranging in the level of carbon intensity. [Biomass gasification](#) is a mature but under-commercialized pathway for producing hydrogen, the same general process used for sustainable aviation fuel production from woody biomass. As with other nascent biofuel industries, capital costs and biomass feedstock costs have challenged the development of these projects.

There are several companies developing biomass-to-hydrogen technologies, with the earliest operations of these projects expected around 2027. [Mote](#) is developing two projects in California that are expected to use around 300,000 metric tons per year of woody biomass each, and produce a combined 42,000 tons of hydrogen. In addition, [Woodland Biofuels](#) is investing \$1.35 billion into a renewable natural gas and hydrogen plant in Louisiana that uses waste biomass.

With \$7 billion in funding from the Bipartisan Infrastructure Law, The Department of Energy has established [Regional Clean Hydrogen Hubs](#) to help scale hydrogen production around the country. In the Midwest, the [Heartland Hydrogen Hub](#) (H2HH) has been allocated \$925 million to develop multiple pilots throughout the region, including Minnesota. However, according to Chad Wocken, Executive Director of Clean Energy Solutions and H2HH, no biomass-to-hydrogen projects are under development in the Midwest.

Wocken also noted that current hydrogen projects are heavily reliant on the [Clean Hydrogen Production Tax Credit](#), also known as Section 45V, in which entities are eligible for a tax credit of up to \$3 per kilogram of clean hydrogen produced. However, the changing political landscape may threaten the availability of this funding.

The [Minnesota Natural Gas Innovation Act](#) (NGIA) may offer an alternative opportunity to develop biomass-to-hydrogen projects. The NGIA is a framework for natural gas utilities in Minnesota to help meet the state's greenhouse gas reduction and renewable energy goals through investment in innovative technologies. Several utilities are developing projects to blend low-carbon hydrogen with natural gas to lower the fuel's carbon intensity.

Five-year NGIA plans were recently approved by the state, but staff at [Centerpoint Energy](#) - a major natural gas utility in Minnesota - noted that they are always investigating future pilots. In addition, the company suggested that there may be internal grant funding available for the development of these projects.

## Wood Pellets

[Wood pellets](#) are a type of biofuel made from compressed organic material, primarily wood fiber. They are produced by processing residuals from the lumber industry, such as sawdust, wood chips, and other byproducts that would otherwise go to waste. The production process involves drying the wood material, grinding it into a fine powder, and then compressing it into small cylindrical shapes using high pressure and heat, which activates lignin—a natural adhesive found in wood—to bind the particles together.

The European Union has [strongly incentivized](#) the use of wood pellets through renewable energy policies, classifying wood burning as having zero carbon emission. Although demand for wood pellets in the United States has remained low, the country has become a major exporter of the fuel, with a [global market share of roughly 27%](#).

There are very few active pellet mills in Minnesota, but the industry's use of waste material and generally large plant sizes could offer a potential utilization solution for the TCMA. According to Tim Baye, Professor of Business Development and Energy Finance Specialist at University of Wisconsin, an average pellet mill can process between 300,000 and 500,000 bone dry tons of woody biomass annually.

However, Baye noted several challenges with developing a pellet industry in Minnesota. Major pellet producers are currently located on the South and East coasts, and competing for overseas demand from the Midwest may be prohibitively expensive. [About three dozen wood pellet manufacturing plants](#) in the South account for nearly 80% of the annual U.S. capacity. In addition, development of a mid-size pellet mill may cost \$50 to \$150 million.

Environmental concerns from pellet manufacturing may also hinder the industry's growth in the United States and challenge its development as a climate-friendly alternative. For example, some communities have [pushed back](#) against the construction of large pellet mills in their neighborhoods, citing severe air quality degradation and respiratory effects.

Federal funding for wood pellet manufacturing may be available through federal programs like the Inflationary Reduction Act tax credits and 2018 Farm Bill subsidies, but environmental groups are pushing for the government to reconsider these incentives. Additionally, because there is no existing pellet industry in Minnesota, it is hard to predict the legislative barriers and level of public controversy that a pellet project would experience.

## Evaluation of Near-Term Strategies to Increase Wood Utilization

Based on the research gathered above, an evaluation of strategies available for implementation in the near-term (i.e., within two years) was conducted. Activities considered to have longer-term implementation horizons (e.g., biofuel production), were excluded from this evaluation, as it is difficult to predict the requisite conditions for enabling these industries.

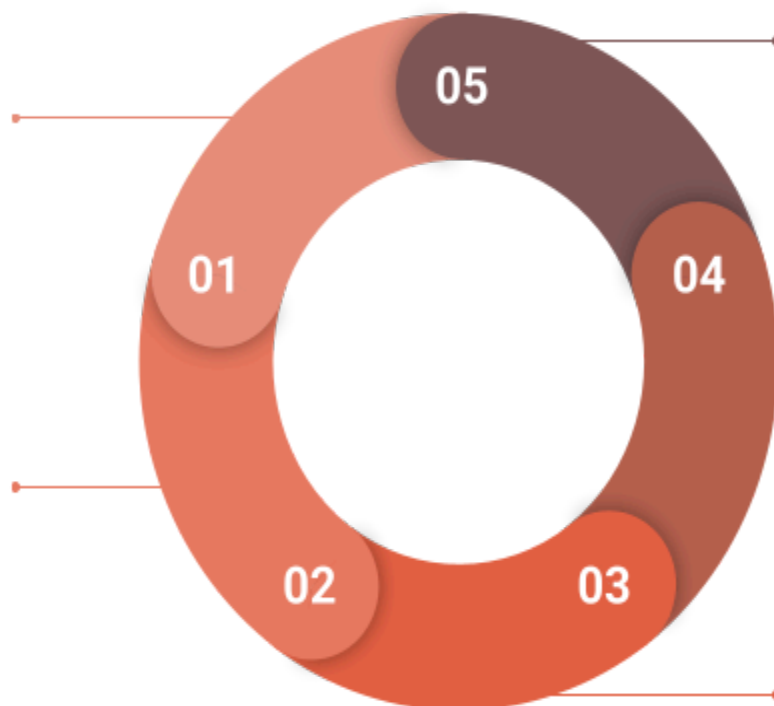
While the Wood Waste Hierarchy approaches wood utilization activities from a life-cycle assessments and carbon sequestration perspective, a range of additional factors were considered to determine the efficacy of management strategies in this evaluation. **Figure 5** outlines the categories and questions used to evaluate potential solutions in the metro area. The goal of this framework is to enable organizations to determine management strategies that best reflect their unique set of priorities. In addition, the activities evaluated below can vary in implementation requirements based on local regulations, community need, and funding availability.

## Amount of Material Managed

- How much wood biomass is used/disposed (volume, weight, etc)?
- How flexible is the feedstock input (slash, logs, species type, etc.)?

## Carbon Sequestration

- What is the direct & indirect carbon sequestration potential and/or emissions generated?
- What are the co-benefits to climate, wildfire mitigation, forest health, local economy, & potential to engage underserved communities or tribes?



## Technology Readiness

- What is the current & potential market demand for end-use products?

## Policy Readiness

- What are potential implementation challenges (i.e., logistics, regulatory requirements, permitting and zoning barriers, level of controversy)?

## Economic Efficiency

- What's the estimated cost per ton of feedstock processed?
- What are the estimated capital costs for implementation?

**Figure 5.** Framework used for evaluation of wood utilization strategies.

Information gathered from stakeholder interviews and literature research was used to develop standard criteria for evaluating the amount of material managed, carbon sequestration, economic efficiency, policy readiness, and technology readiness of different wood utilization strategies. Criteria used to determine the policy readiness of strategies was developed in conjunction with the Partnership’s policy team, outlined in **Table 3**.

**Table 3:** Difficulty of Strategy Implementation Based on Policy Readiness

<u>High</u>	<u>Medium</u>	<u>Low</u>
<ul style="list-style-type: none"> <li>● May require changes to state statute or rules</li> <li>● May require changes to local ordinances or zoning</li> <li>● Extensive permitting requirements</li> <li>● Highly controversial in a legislative, state regulatory process or local political environment</li> </ul>	<ul style="list-style-type: none"> <li>● Likely subject to challenging ordinance or zoning restrictions</li> <li>● Permitting may be slow or challenging</li> <li>● Some level of controversy</li> </ul>	<ul style="list-style-type: none"> <li>● No known state statute or rule restrictions</li> <li>● Limited ordinance or zoning restrictions</li> <li>● Limited permitting requirements</li> <li>● Low level of controversy</li> </ul>

**Table 4** evaluates potential near-term strategies for increasing biomass utilization in the metro area using a low, medium, and high scoring matrix. The strategies proposed below also assume that existing outlets for wood (e.g., SPC, SMSC, and Koda Energy) remain active.

The activities displayed represent a non-comprehensive set of options, and the Partnership should adapt this framework as the situation in the metro area evolves. This evaluation summary can be used to inform decision-making efforts during policy review, process changes, and design of wood waste management plans. The information below should also be reviewed and updated as technologies and the situation in the metro area evolve.

**Table 4.** Evaluation Summary of Proposed Near-Term Strategies to Increase Wood Utilization

<b>Proposed Strategy</b>	<b>Amount of Material Managed (tons)</b>	<b>Carbon Sequestration<sup>a</sup></b>	<b>Economic Efficiency (Cost per ton)</b>	<b>Policy Readiness<sup>b</sup></b>
<b>Bioenergy:</b> Purchasing a “turn-key” energy recovery unit for campus heating and power	<b>High</b> >15,000	<b>Low</b>	<b>Low</b> >\$75	<b>Medium</b>
<b>Durable Wood Products:</b> Partnering with a local start-up using wood waste in carbon dioxide removal (CDR) projects	<b>Medium</b> 5,000-15,000	<b>High</b>	<b>Medium</b> \$25-\$75	<b>Medium</b>
<b>Durable Wood Products:</b> Partnering with a major wood pallet producer in the region	<b>Low</b> 1,000-5,000	<b>High</b>	<b>High</b> <\$25	<b>High</b>
<b>Soil Amendments:</b> Purchasing a “turn-key” modular biochar unit (e.g., air curtain burner) for use at an existing wood yard	<b>Medium</b> 5,000-15,000	<b>Medium</b>	<b>High</b> <\$25	<b>Medium</b>
<b>Bioenergy:</b> Supplying woody biomass to refuse-derived fuel plants	<b>High</b> >15,000	<b>Low</b>	<b>High</b> <\$25	<b>Low</b>

<sup>a</sup>The carbon sequestration criteria mirrors guidance outlined in the Wood Waste Hierarchy (see Figure 4). CDR was characterized as a durable wood product and is not considered in the Wood Waste Hierarchy.

<sup>b</sup> See Table 3 for more information on the criteria used for policy readiness

## Processes and Policies to Enable Increased Utilization

There are a variety of processes and policies available to enable development of the technologies discussed above. At the regional level, ongoing development of 20-year County Solid Waste Management Plans offer an opportunity to emphasize wood utilization and comprehensive data collection throughout the TCMA. The Partnership should also consider supporting policies that bolster existing funding sources and research programs related to wood waste. In addition, there are a variety of grants and incentives that could be pursued to develop wood utilization initiatives in the TCMA.

## Policies to Enable Near and Long-Term Solutions

**Update wood waste and EAB projections to inform investment strategies.** Data from the MDA and EQB projecting the spread of EAB and wood waste volumes have not been updated since 2019, which projected a large range of when peak infestation is likely to occur. Additionally, current management systems at the state and local levels lack the ability to track annual wood waste volumes and characteristics. Refining these estimates would help to inform waste management strategies.

Large utilizers of woody biomass, such as developers of SAF and hydrogen projects, also expressed the importance of estimating woody biomass availability in order to inform investment decisions. Companies generally seek long-term feedstock agreements (i.e., 5 years or longer) with woody biomass suppliers to guarantee material to their facility and de-risk capital expenditures. In addition, data on the characteristics of available material supports businesses that may have specific feedstock and processing requirements.

The [Bioeconomy Development Opportunity \(BDO\) Zones](#) initiative offers an alternative opportunity to support wood waste quantification in the metro area. The program certifies 'regional readiness' for biomanufacturing based on an area's given feedstock supply, modeling their analysis using traditional credit ratings. Region Nine is currently the only location in Minnesota to have received a BDO Zone rating, through support from the [Region Nine Development Commission](#).

In conversations with the Region Nine Development Commission and other stakeholders familiar with the BDO Zone Initiative, the program has several limitations. Costs incurred to receive a rating often exceed \$100,000, and the analysis is typically only performed for a single feedstock type in a region.<sup>9</sup> In addition, BDO Zones are a fairly new initiative and it is unclear at this time how receiving the certification impacts investment decisions.

Despite these drawbacks, stakeholders acknowledge that the BDO Zones Initiative underscores a desire for woody biomass utilizers to have data on the quantity and quality of material in an area. Cambium recommends that the Partnership continue to monitor programs such as BDO Zones to aid efforts in quantifying feedstock availability in the region.

**Support woody biomass energy production through implementation of the Carbon-free Standard for electricity and future legislative efforts.** In 2023, Minnesota passed the Carbon-free Standard for electricity under [Statute §216B.1691](#), requiring that 80% of electricity supplied by utilities be carbon-free by 2030 and 100% by 2040. Regulatory efforts are ongoing

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<sup>9</sup> External funding is available for regions looking to pursue a BDO Zone rating. For example, the Region Nine Development Commission received a \$100,000 grant from the HeroX Federal Prize to develop their BDO Zone certification. However, the majority of this award had to be spent on the certification itself, while the internal staff time dedicated to supporting the project went unfunded.



to precisely define the “carbon-free” technology suite, with discussions of woody biomass energy production currently focused on “partial-compliance” with the Standard.

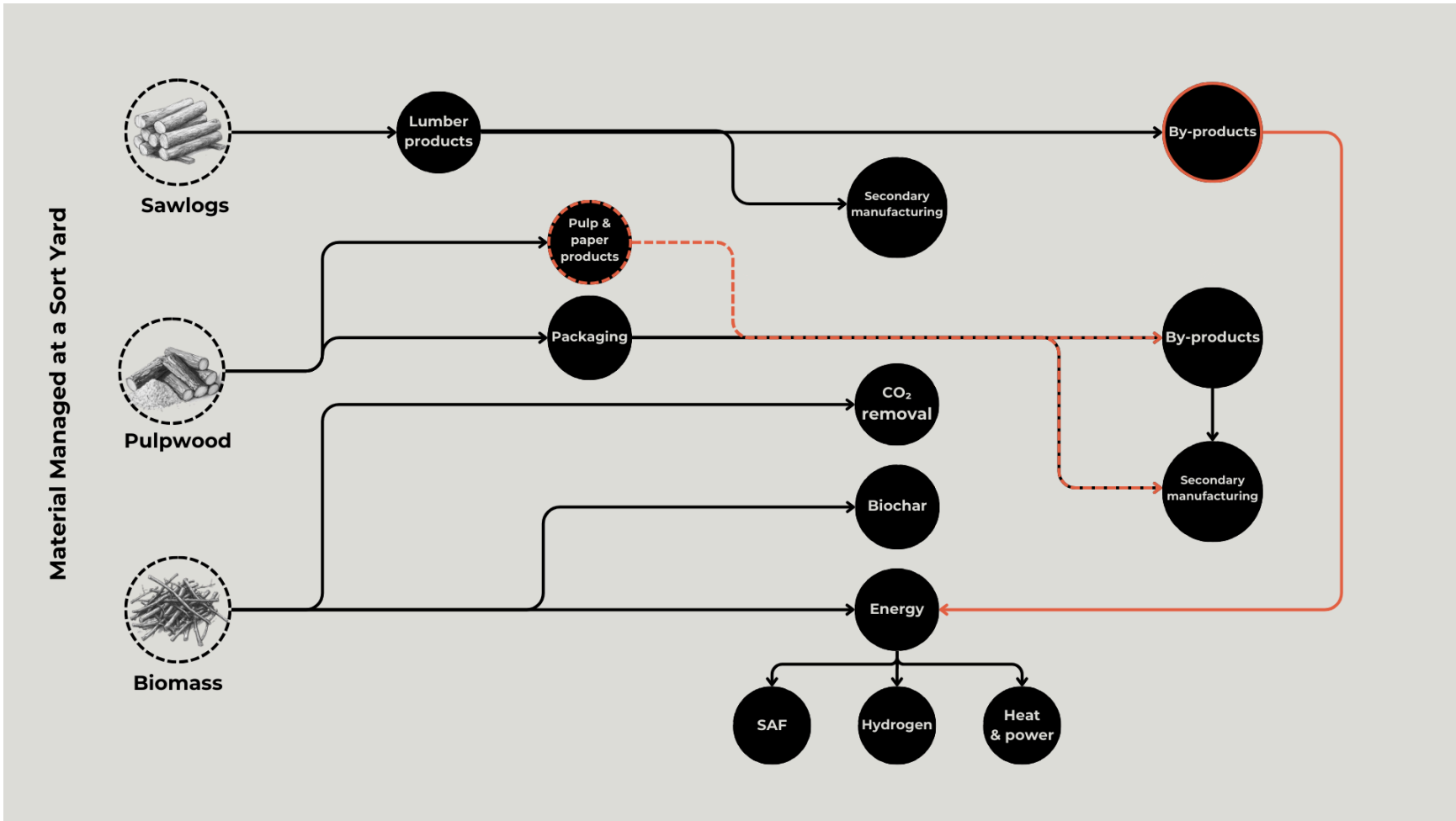
In alignment with the Partnership’s comments in the Public Utility Commission proceedings, Cambium recommends approaching woody biomass energy production with consideration of net emissions and life-cycle assessments. As discussed above, the counterfactual of biomass utilization in the metro area is often open burning, an activity associated with significant environmental and public health effects. Similarly, District Energy and Koda Energy currently play outsized roles in woody biomass processing, and their ability to support wood waste management largely depends on the outcome of these rulings.

The Partnership should continue closely monitoring the science of wood energy as the legislative landscape evolves. In particular, a refined understanding of the alternative disposal fate of woody biomass in the region would help project the consequences if wood energy is not allowed under the Carbon-free Standard for electricity.

**Seek opportunities to develop new sort yards and diversify markets at existing sort yard locations.** The recent [Washington County RFP for Yard Waste Processing](#) offers a novel model for incentivizing the growth of various product markets. The Partnership should look for opportunities to leverage similar frameworks at existing sort yards, in addition to installing new facilities to support development of a sort-yard “network”. Funding sources such as the [USFS Wood Innovations Grant](#) could be pursued to help build offtake markets and partnerships with woody biomass utilizers.

Cambium recommends exploring the development of a “network” of sort yards, wherein multiple drop-offs points around the metro area are available for accepting material from generators and subsequently processing it for utilizers. Strategically locating these sort yards would alleviate transportation costs for both generators and utilizers while maximizing the associated value of feedstock. Decoupling these sort yards from individual companies would also help to bring in an array of procurement opportunities.

**Figure 6** illustrates the potential downstream flow of material under a diversified wood waste management system, supported by a sort yard “network”. Woody biomass is efficiently processed and source separated (e.g., logs, chops, and slash) to allow for uptake from a diverse set of utilizers. In addition, market enablers (e.g., BDO Zones) and policy incentives are available at multiple stages in the system to support product development.



**Figure 6.** Idealized illustration of a diversified wood waste management system. [Adapted from the Forest Resources Association.](#)

**Support legislative initiative to bolster existing state funding programs that offer support to both private organizations and municipalities.** The 2024 [MPCA Wood Utilization Grant](#) is a new, one-time program offering up to \$250,000 for projects in Minnesota looking to improve biomass utilization through energy production, soil amendments, carbon storage, durable wood products, and other projects that demonstrate benefits aligned with the Wood Waste Hierarchy. However, the \$1 million of total available funding through the program is widely seen as insufficient for addressing the scale of wood waste management challenges in the state. For reference, woody biomass processors often highlight that the costs of a horizontal grinder alone can exceed \$1 million, not including the requisite staff or fuel costs. Other pieces of “turn-key” equipment such as biochar units can range in price from \$150,000 to nearly \$8000,000. The Partnership should work to support establishment of an on-going, more robustly funded state grant program.

While contracts are not expected to be finalized until the spring of 2025, preliminary data shows that the grant program received 56 applicants requesting a cumulative \$8.9 million dollars in funding. This large discrepancy between requested and available funds underscores the need for more robust state grant programs related to wood waste management and utilization.

As noted in the 2022 study, the [MDA AGRI Bioincentive Program](#) offers another major avenue in Minnesota for incentivizing highest and best uses for wood waste. The program currently provides incentive payments for production of advanced biofuel, renewable chemicals, biomass thermal energy, and siding.

**Table 5** outlines the annual appropriation amounts allocated to the Bioincentive Program since its inception. Funding for 2024-2025 biennium is \$5,750,000 and is expected to drop to \$3,000,000 starting in fiscal year (FY) 2026.

**Table 5: AGRI Bioincentive Program Appropriations**

Biennium	Year 1	Year 2
2016-2017	\$500,000	\$1,500,000
2018-2019	\$1,500,000	\$1,500,000
2020-2021	\$2,500,000	\$2,500,000
2022-2023	\$4,500,000	\$5,750,000
2024-2025	\$5,750,000	\$5,750,000
2026-2027	\$3,000,000	\$3,000,000

Source: MDA Minnesota Incentive Programs Annual Report

Claims have been made across all eight fiscal years of the incentive program. Unspent funds at the end of the fiscal year are available to the entire AGRI program in the following fiscal year, yet since 2019 claims have been higher than funding. In F22 and F23, claims exceeded the total funding available by roughly \$3.4 million and \$2.9 million, respectively. It is projected that claims will be approximately \$7.1 million in both FY24 and FY25. In review of all claims submitted FY17 through FY23, biomass thermal energy continues to make up a small percentage of total claims (8.4%), likely due to the production type having the least appropriated funds. The advanced biofuel and renewable chemical incentives are not known to have any claims made from producers using woody biomass as a feedstock.

Funding for the biomass thermal energy category remains low, and Cambium continues to recommend lobbying for a shift in allocation funds and/or increase in funding to support this sector. Additionally, opportunities to enable claims from biofuel and renewable chemical producers that use woody biomass as a feedstock should be encouraged. A 20% bonus payment is currently available for renewable chemicals and biomass thermal energy producers utilizing agricultural perennials and/or cover crops as feedstock - extending this incentive to woody biomass should be explored.

There continues to have been no claims made for the siding production incentive and no expressed interest from producers. In 2023, the Minnesota Legislature repealed the oriented strand board incentive that was anticipated to begin in 2025. It is recommended that the program undertake an evaluation of interest in the siding incentive and further explore where market demand may be better met. In addition, the Partnership should support opportunities to expand utilization of urban wood waste through the engineered wood product industry in Minnesota.

**Create mechanisms for collaboration across government agencies engaged in wood waste management.** As the evaluation of various woody biomass technologies above illustrates, a myriad of factors are necessary to determine the feasibility of a utilization strategy, including its climate impact, economic efficiency, and the amount of material managed. State agencies engaged in wood waste management may have competing priorities, hindering advancement of potential solutions. Cambium recommends seeking collaboration between groups such as the Partnership, MPCA, Department of Commerce, MDNR, MDA, and MN Forest Resources Council to advance policy and investment opportunities. For example, stronger partnership between these agencies offers an important set of relationships to inform the PUC decision making around the use of woody biomass used in electricity generation and fuel applications. Collaboration could be facilitated through existing forums such as the Environmental Quality Board.

## Grants and Incentives

There are a variety of public and private funding avenues to support wood waste utilization and management. **Table 6** below outlines potential grant opportunities, along with their maximum

award amounts and a brief description of their focuses. The funding requirements and type of institutions allowed to apply each vary significantly, as do the application timelines.

While several of the grants listed below are wood-specific, others are tangentially beneficial to wood waste management. For example, agricultural programs like the Conservation Innovation Grant can support woody biomass utilization by developing markets for compost and biochar. Cambium recommends using the list in **Table 6** as a non-exhaustive set of opportunities that the Partnership could apply for directly or support via partnerships.

**Table 6.** Grant Opportunities to Support Wood Waste Utilization and Management

Grant Name	Funding Institution	Maximum Award Amount	Description
<a href="#">AGRI Sustainable Agriculture Demonstration Grant Program</a>	Minnesota Department of Agriculture	\$50,000	Supports innovative on-farm research and demonstrations. Projects explore sustainable agriculture practices and systems that could make farming more profitable or resource-efficient, such as improving soil health.
<a href="#">Wood Waste Utilization Grant</a>	Minnesota Pollution Control Agency	\$250,000	This grant program aims to reduce open burning, land disposal, and landfilling of woody biomass by funding projects that improve utilization of this resource for energy production, soil amendments, carbon storage, durable wood products, and other projects that demonstrate beneficial use as laid out in the wood utilization hierarchy.
<a href="#">Climate-Smart Food Systems</a>	Minnesota Pollution Control Agency	\$60,000,000 (Total)	Minnesota was awarded \$200 million from EPA's CPRG program to establish a climate-smart food system initiative to fill critical investment gaps and accelerate momentum toward a more equitable, climate-smart food system. This includes \$60 million for investments in food and organic material processing sites, which could support the use of woody biomass.
<a href="#">Civil Infrastructure Systems</a>	National Science Foundation	\$600,000	Supports fundamental and innovative research in design, operation and management of civil infrastructure that

Grant Name	Funding Institution	Maximum Award Amount	Description
			contributes to smart, sustainable and resilient communities at local, national and international levels. Focus on spatially- and functionally- distributed components and intersystem connections. Could be pursued to study the development of sort yard “networks” in the TCMA.
<a href="#">Pre-Disaster Mitigation Grant Program</a>	Federal Emergency Management Agency	\$10,000,000	Provides states, local communities, tribes & territories funding for eligible mitigation activities to strengthen their ability to build a culture of preparedness by reducing disaster losses & protecting life and property from future disaster damage. Could be pursued to support prevention of future ecological disasters.
<a href="#">Conservation Innovation Grants</a>	National Resource Conservation Service	\$2,000,000	Funding to develop conservation technologies, management systems, and innovative approaches to agricultural production, such as improved soil health.
<a href="#">The Earthshot Prize</a>	The Royal Foundation	\$1,000,000	A yearly prize established in 2021 for climate change projects. Focus categories include Protect and Restore Nature, Clean Our Air, Revive Our Oceans, Build a Waste-Free World, and Fix Our Climate. Have previously awarded Amsterdam and Milan prizes for their work developing a circular economy.
<a href="#">Solid Waste Infrastructure for Recycling Grants for Communities</a>	Environmental Protection Agency	\$5,000,000	Projects that are designed to build and transform solid waste - including woody biomass - infrastructure in the United States to equitably reduce waste and manage materials to achieve a circular economy, reduce greenhouse gas emissions, and create cleaner, resilient, and healthier communities.

Grant Name	Funding Institution	Maximum Award Amount	Description
<a href="#">Small Business Innovation Research Program</a>	Environmental Protection Agency	\$500,000	Funding for small businesses to develop environmental technologies with focuses on clean and safe water, air quality, homeland security, sustainable materials management, safe chemicals, and risk assessment.
<a href="#">Wood Innovations Grant Program</a>	US Forest Service	\$1,000,000	The Community Wood Grant Program, launched in 2020, provides funding for grants to install thermally led community wood energy systems or to build innovative wood product manufacturing facilities.

## Wood Waste Management Strategies

The MPCA's [Metropolitan Solid Waste Management Plan](#) provides a framework for counties to update their solid waste management plans over a 20-year outlook. As part of the current round of updates, counties are required to develop plans to prevent and manage wood waste throughout the region. Specifically, they are expected to improve data collection efforts and set goals around wood waste management that offer the greatest environmental benefits. Strategic development of these plans offer counties the opportunity to maximize waste diversion, revenue generation, workforce development, and emissions reduction. Cambium recommends that the Partnership considers the following features within their plans:

**Data Collection.** Understanding the potential scale of the system by evaluating the local wood waste stream is critical to identify the infrastructure and capacity needed to process biomass. While current assumptions and management plans are generally based on rough estimates and trends, significant data gaps remain and hinder the adoption of large-scale processing systems. Registering wood yards and requiring them to report material flow through a consolidated platform (e.g., MPCA's SCORE database) would allow for efficient data collection and analysis. Specific data elements wood yards should consider reporting on include:

- Volume and/or weight of raw material collected by type (e.g., whole log, brush, chips, mulch), categorized by green or dry
- Volume and/or weight of raw material collected by species
- Volume and/or weight of raw material transferred to other sort yards
- Volume and/or weight of material processed by product category (e.g., mulch, compost, biochar, lumber, pulp, syngas, SAF, mulch/chips for energy, pellets, firewood)

In addition, counties should work to update tree inventory data, including a determination of how many EAB-infested trees are treated on an annual basis. Refining wood waste projections within the metro area is a critical step to attracting new processing capacity, as partners seek greater certainty in feedstock availability before investing in additional biomass utilization infrastructure.

**Program Design.** There are several operational models for establishing local biomass utilization programs, with varying degrees of government support. In addition to these case studies, the Arbor Day roadmap for [Value Capture Through Biomass Utilization](#) provides a useful framework for communities looking to develop local wood utilization programs.

**Table 7.** Select Wood Waste Operational Models

Model Type	Potential Benefits	Potential Challenges	Example in Metro Area
<b>Contracted</b>	<ul style="list-style-type: none"> <li>● Minimal capacity required from municipal staff</li> <li>● Allows specialized operator to manage processing</li> <li>● Option to recover some material for public use</li> <li>● Public RFP mitigates legal asset transfer issues</li> </ul>	<ul style="list-style-type: none"> <li>● Need to engage qualified partners to bid on RFP</li> <li>● May prove less viable for grant support</li> <li>● Lower potential value recuperation for local government</li> <li>● Biomass capture limited to specific project type</li> </ul>	Carba's partnership in the Burnsville Landfill
<b>Public</b>	<ul style="list-style-type: none"> <li>● Value &amp; resource capture within direct local government control</li> <li>● Opportunities to leverage grant and government funding to kickstart implementation</li> <li>● Potential to maximize municipal log collection</li> </ul>	<ul style="list-style-type: none"> <li>● Staff capacity required to design and operate</li> <li>● Regulations and liability concerns may be a hurdle</li> <li>● Growth constrained by budgeting process</li> <li>● Local government responsible for offtake and distribution of product</li> </ul>	Minneapolis Biochar Facility
<b>Public-Private</b>	<ul style="list-style-type: none"> <li>● Development &amp; program scaling can occur outside local government budgeting processes</li> <li>● Opportunities to leverage grant &amp; government funding to kickstart implementation</li> <li>● Potential to maximize municipal-wide log collection</li> </ul>	<ul style="list-style-type: none"> <li>● Need to engage qualified partners to bid on RFP</li> <li>● Finding and outfitting a suitable site</li> <li>● Establishing Standard Operating Procedures with private partners</li> </ul>	Washington County and Ramsey County sort yards



**Goal setting.** Outcomes and success metrics will be determined based on the goals and needs of specific biomass utilization projects. The Partnership counties should set goals within their wood waste plans and identify the right team members to support them.

- **Public Engagement.** Receiving feedback from existing players in tree care and wood processing is an important step in understanding the opportunities and barriers to improve wood reuse and diversion initiatives. The Partnership could consider setting the following goals related to public engagement:
  - Have one representative join the MPCA wood waste stakeholder group every quarter.
  - Solicit feedback annually from community members and commercial users of woody biomass yards to understand how needs are met.
  - Sharing progress updates related to wood waste management with key stakeholders annually.
- **Offtake markets.** Developing markets for salvaged wood is critical to ensure long-term financial sustainability of a management program. Counties should emphasize building a diverse product market by engaging a range of procurement partners, while ensuring that processors reflect the priorities of the Wood Waste Hierarchy and Evaluation Framework. The Partnership should consider setting goals related to procuring offtake agreements for wood collected at county-owned sites.
- **Funding Opportunities.** The Partnership should identify key personnel and/or processes to enable alternative funding sources for waste management.

## Summarized Recommendations and Next Steps for The Partnership

- Update wood waste and EAB projections to inform investment strategies
- Support woody biomass energy production through implementation of the Carbon-free Standard for electricity and in future legislative efforts
- Seek opportunities to develop new sort yards and diversify markets at existing drop-off locations
- Support legislative initiatives to bolster existing funding programs that offer support to both private organizations and municipalities
- Create mechanisms for collaboration across government agencies engaged in wood waste management
- Analyze opportunities to pursue external grants and market enablers

# Appendix

## Stakeholder Interviews

Cambium interviewed over 25 different groups to understand the current state of wood waste management and potential for increasing wood utilization in the Twin Cities. Stakeholders consisted of wood waste generators, primary and secondary processors, government and policy advocates, and market developers. Most of these organizations are Minnesota-based, but some have a regional or national presence. **Table 8** provides a brief overview of the groups we spoke to and a description of their work.

**Table 8.** Overview of Stakeholder Interviews

Stakeholder	Organization Type	Location	Description	Contact(s)
Hugo Tree Care	Generator	Hugo, MN	Tree services and tree removal, land clearing	<ul style="list-style-type: none"> <li>Harry Olsen, COO/Co-Owner</li> </ul>
The Davey Tree Expert Company	Generator	South St. Paul, MN	Tree services and tree removal, mulching	<ul style="list-style-type: none"> <li>Mike Dye, District Manager</li> </ul>
Dakota Wood Grinding	Primary Processors	Rosemount, MN	Wood grinding, composting	<ul style="list-style-type: none"> <li>John Guillemette, Owner</li> <li>Ethan Ladwig, Equipment Manager</li> </ul>
LJP Waste Solutions	Primary Processors	North Mankato, MN	Landfilling, RDF production	<ul style="list-style-type: none"> <li>Jesse Samuelson, Director of Business Development</li> </ul>
SMSC Organics	Primary Processors	Shakopee, MN	Wood grinding, composting, mulching	<ul style="list-style-type: none"> <li>Erin Skelly, Compost Operations Manager</li> <li>Dustin Montey, Director</li> </ul>
Ceres Environmental	Primary Processors	Brooklyn Park, MN	Tree waste recycling, mulching, composting	<ul style="list-style-type: none"> <li>Jim Carlson, Sales and Account Manager</li> </ul>
Clear Water Nitrate Reduction	Secondary Processors	Minneapolis/St. Paul, MN	Wood waste consulting, biochar production, conservation projects	<ul style="list-style-type: none"> <li>Marshall Erickson, Operations/Business Development</li> </ul>
Carba	Secondary Processors	Burnsville, MN	Carbon dioxide removal technology	<ul style="list-style-type: none"> <li>Andrew Jones, CEO and Founder</li> </ul>

Stakeholder	Organization Type	Location	Description	Contact(s)
Savanna Pallets	Secondary Processors	McGregor, MN	Wood pallet manufacturer	<ul style="list-style-type: none"> <li>Allen Raushel, Sales Manager</li> </ul>
Comstock Fuels	Secondary Processors	Wausau, WI	Production of syngas and advanced biofuels from lignocellulosic biomass	<ul style="list-style-type: none"> <li>David Winsness, President</li> </ul>
District Energy/St. Paul Cogeneration	Secondary Processors	St. Paul, MN	Energy recovery facility	<ul style="list-style-type: none"> <li>Ken Smith</li> <li>Chris Peterson</li> <li>Nick Wyczawski</li> </ul>
EnVerde	Secondary Processors	Minneapolis, MN	Modular gasification unit (under development)	<ul style="list-style-type: none"> <li>David Goebel, CEO and Founder</li> </ul>
City of Minneapolis	Secondary Processors	Minneapolis, MN	Municipal biochar pilot	<ul style="list-style-type: none"> <li>Jim Doten, Carbon Sequestration Program Manager</li> </ul>
Recycling & Energy	Secondary Processors	Ramsey and Washington Counties, MN	Anaerobic digester (under development)	<ul style="list-style-type: none"> <li>Michael Reed, Division Manager</li> <li>Sam Holl, Facilities Manager</li> <li>Dan Donkers, Program Analyst</li> </ul>
Koda Energy	Secondary Processors	Shakopee, MN	Waste-to-energy facility	<ul style="list-style-type: none"> <li>Stacy Cook, President</li> </ul>
CenterPoint Energy	Secondary Processors	Minneapolis, MN	Natural gas utility	<ul style="list-style-type: none"> <li>Betsy Lang, Lead Analyst</li> <li>Nick VanDuzee, Energy Efficiency Engineer</li> </ul>
NXTClean Fuels	Secondary Processor	Oregon and Texas	Sustainable aviation fuel production	<ul style="list-style-type: none"> <li>Christopher Efrid, Founder</li> </ul>
Minnesota SAF Hub/Greater MSP	Market Developers	St. Paul, MN	Sustainable aviation fuel policy research and support	<ul style="list-style-type: none"> <li>Julia Silvis, Managing Director</li> </ul>
Minnesota Pollution Control Agency	Government and Policy Partners	St. Paul, MN	Wood waste requirements and stakeholder support	<ul style="list-style-type: none"> <li>Jon Klapperich, Wood Waste Specialist</li> </ul>

Stakeholder	Organization Type	Location	Description	Contact(s)
				<ul style="list-style-type: none"> <li>Alison Cameron, Environmental Specialist</li> </ul>
Great Plains Institute	Government and Policy Partners	Minneapolis, MN	Environmental non-profit with a range of initiatives, including transportation and biofuels	<ul style="list-style-type: none"> <li>Brendan Jordan, Vice President</li> </ul>
Minnesota Department of Transportation	Government and Policy Partners	St. Paul, MN	Biochar utilizer	<ul style="list-style-type: none"> <li>Dwayne Stenlund, Erosion Control Specialist</li> </ul>
Minnesota Forest Resources Council	Government and Policy Partners	Falcon Heights, MN	Appointed by the governor to recommend sustainable forest management policies and practices	<ul style="list-style-type: none"> <li>Pete Aube, Chair</li> </ul>
Region Nine Development Commission	Government and Policy Partners	Mankato, MN	Recipient and manager of BDO Zone award for Region Nine, MN	<ul style="list-style-type: none"> <li>Nicole Griensewic, Executive Director</li> <li>Samuel Sharp, Energy and Sustainability Planner</li> </ul>
Heartland Hydrogen Hub	Government and Policy Partners	Grand Forks, ND	Clean energy project awarded \$925 million from DOE to catalyze low-carbon hydrogen production in the midwest	<ul style="list-style-type: none"> <li>Chad Wocken, Assistant Director</li> </ul>
University of Wisconsin	Government and Policy Partners	Madison, WI	Wood pellet fuels market expertise	<ul style="list-style-type: none"> <li>Tim Baye, Professor of Business Development/Energy Finance</li> </ul>
EcoStrat	Market Developers	Toronto, ON	Developer of the BDO Zone Initiative	<ul style="list-style-type: none"> <li>Peter Wolf, Project Director</li> <li>Aryn Garswood, Head of BDO Zone Initiative</li> </ul>