

Credit Memo

Date: June 11, 2025

To: MnCIFA Credit Committee – Meeting Date June 11, 2025

From: Peter Klein

RE: Carba Inc. - \$500,000 Financing Request

Action Requested:

Approval of up to a \$500,000 loan to Carba Inc. for their first pyrolysis reactor that will repurpose negative-value woody biomass from Waste Management's SetMN compost facility in Burnsville Minnesota, with operations target to launch by Q4 2025. Carba intends to come back to MnCIFA for an additional \$2,000,000 at the December board meeting. The MnCIFA staff will revisit the project at time and provide a standalone recommendation to the Board.

Background:

Carba, Inc. was founded to address the urgent need for scalable and permanent carbon dioxide removal (CDR) solutions and pollution clean-up. The company leverages cutting-edge pyrolysis technology to convert negative and low-value biomass into stable, recalcitrant carbon, which is then buried to ensure long-term sequestration. Carba's innovative approach to carbon removal was developed by Professor Paul Dauenhauer from the University of Minnesota and Dr. Andrew Jones, a Ph.D. from UC Berkeley, both renowned experts in chemical engineering and sustainable technology. This will be the earliest stage technology that MnCIFA has funded to date.

Proposed Project:

The project seeking MNCIFA support is the Minnesota Enhanced Carbon Removal project. This initiative is a collaboration between Waste Management of Minnesota. (WM) and Carba, Inc. The project aims to repurpose negative-value woody biomass from WM's SetMN compost facility in Burnsville, MN. Carba's proprietary pyrolysis reactors convert this biomass into biocarbon (charcoal), which is then utilized as an additive material to daily cover at the Burnsville Sanitary Landfill, Inc. (BSL) for permanent carbon removal and pollution control.

Carba is an early stage start-up but its technology applies the well-established pyrolysis process through an innovative, autothermal design. Carba discovered in their research that keeping the pyrolysis temperature under 467 °C led to a high solid biocarbon yield but the issue was the process

would take too long. The team found a way to drastically increase the reaction speed with a molten salt heating system. In addition, Carba's portable reactor design specifically addresses common failure points of other existing technology solutions in the market. Carba lowered the fixed costs, built the system to handle a wide range of feedstocks, made it autothermal, and made it modular and portable to avoid shipping biomass long distance.

Specific Technologies Utilized:

- **Proprietary Reactors:** Carba's pyrolysis reactors operate at temperatures between 350-550°C to convert biomass into biocarbon. These reactors are also unique in their ability to process a wider range of feedstocks than what is currently commercially available.
- **Pyrolysis Process:** This process converts the carbon found in biomass into a stable form, biocarbon, by heating at high temperatures in the absence of oxygen. Biocarbon is formed by driving off the food value and water found in biomass and converting it into a recalcitrant aromatic biocarbon that resists degradation.
- **Low-Oxygen (functionally anoxic) Burial:** In this project, the biocarbon is buried in landfills as an additive material to daily cover, ensuring permanent carbon sequestration and acting as a pollution control tool for reducing odors from the landfill, adsorbing contaminants such as PFAs and reducing methane emissions with methanotrophs (which breaks down methane) which are housed in biocarbon.

Competitive Benefits of Technology:

- **Energy Efficiency:** The Carba reactor uses only 70 kWh per metric ton of CO₂ captured - significantly lower than alternative carbon removal methods.
- **Deployment Flexibility:** The modular design allows us to bring processing directly to biomass sources, reducing transportation costs and emissions.
- **Automation IP:** Carba is leveraging the Founders' past knowledge to automate the system based on how far along the reactions are → enabling us to process a wide range of feedstocks quickly.
- **Burial IP:** We have pending patents on the burial and MRV of biocarbon for pollution and carbon removal benefits.
- **Proven Results:** Successfully operated prototype for one year, demonstrating consistent biochar quality and carbon yields of 60-80%.
- **Cost Advantage:** Lower capital and operating costs compared to centralized facilities or other carbon removal technologies.
- **Scalability:** Modular design enables rapid deployment of multiple units without building large fixed infrastructure.

Projects Technical Benefits:

- **GHG Emissions Reductions:** Landfills represent one of the largest sources of methane emissions both nationally and globally. The biocarbon material creates an ideal habitat for methanotrophs, specialized bacteria that naturally consume and break down methane gas into CO₂, which has potential to significantly reduce fugitive landfill methane emissions.

- **PFAs and Heavy Metals Removal:** The biocarbon's highly porous structure and large surface area create powerful adsorption properties that effectively capture and retain both PFAS and heavy metals commonly found in landfill waste, preventing these contaminants from migrating into the surrounding environment, groundwater and municipal water.
- **Odor Reduction:** The biocarbon acts as a carbon filter on top of the active landfill. As odors are generated from decomposing waste, they are trapped within the biocarbon's porous structure, reducing or eliminating the compounds that would normally be released into the surrounding air.
- **Carbon Sequestration:** The project ensures the permanent sequestration of carbon, contributing to long-term climate goals. By repurposing biomass waste from the Minneapolis metropolitan area that would otherwise decompose or be composted (processes that release significant greenhouse gases) and converting it into stable biocarbon, the project achieves permanent carbon sequestration. This impact is documented through comprehensive life cycle analysis, the counterfactual scenarios of the biomass fate without Carba's intervention, and measured following rigorous and third party audited carbon removal protocols and reports.

Economic Benefits:

- **Job Creation:** The project creates jobs in reactor operation, biomass processing, and landfill management, supporting local employment.
- **Community Engagement:** Carba commits to hiring locally, educating, and engaging with the community, fostering a sense of involvement and benefit.
- **Economic Scaling:** The project offers economic scaling opportunities through partnerships with local agencies like the MPCA, Environmental Resources from all MN Counties & municipalities and private companies as well.
- **Carbon Credit Revenue:** The project is expected to generate verified carbon credits through measurable CO2 removal, creating a potential recurring revenue stream via voluntary and compliance carbon markets.

Carba Business Highlights:

- **Commercial:** Recently Carba signed a 5-year 44,000 ton carbon off-take agreement with Microsoft around the first site in Burnsville, MN (Carba - Microsoft Carbon Purchase Agreement) and finalized a 1,000 year carbon removal protocol with Isometric (Isometric - Carba Protocol).
- **Financing:** Carba secured PRI project financing to fund design work and capex for the Burnsville project (majority in this PRI led by the Schmidt Family Foundation).
- **Engineering:** The full scale commercial system design has been finalized, the major equipment has been contracted, and the first equipment is in production. The targeted delivery date for all the equipment is by August 2025, this summer.
- **Operations:** Carba continues to run the R&D pilot at the Waste Management landfill in Burnsville and are finalizing the last pieces of the site planning for full scale production. Everything is on track for commercial start-up by September this year.

Community Benefits

Carba's first reactor will not be in an environmental justice community. However, the project has benefits to the surrounding area.

- Emissions Reductions: The implementation of biocarbon as an additive material to daily cover creates a filtration system that actively reduces the total greenhouse gas emissions from landfill operations, directly reducing the greenhouse gas impact from landfills on the environment.
- Improved Water Quality: The biocarbon acts as a point source filter, capturing PFAS and heavy metals before they can accumulate in landfill leachate. This prevents these persistent compounds from leaching into the environment or reaching wastewater treatment facilities, where they can pass through and potentially contaminate municipal water supplies.
- Local Air Quality Improvements: The biocarbon cover system creates an effective barrier that captures and neutralizes odorous compounds at their source, preventing them from affecting nearby residential areas and improving the quality of life for local communities.
- Equity and Environmental Justice: The project specifically targets improvements in landfill operations that benefit communities that are exposed to environmental pollutants from anthropogenic activities. The project aims to improve the environmental quality and public health through measurable reductions in air and water contamination from landfills.
- Shakopee Mdewakanton Sioux Community: Carba received a \$500k SAFE note and received interest to plan a project with the community to create jobs and permanently remove carbon on tribal lands.

Sources and Uses

At this time, MnCIFA will only be funding reactor one, as 20% of the capital stack. Once the first reactor is operational and performing to expectations as a proof of concept, MnCIFA will consider another application from Carba Inc. for reactor 2-4. Approval of the Reactor 1 loan does not guarantee a loan for reactors 2-4.

Category	Item	Reactor 1 (\$)	% of Total	Reactors 2-4	% of Total	Total (\$)	% of Total
Sources	PRI*	\$1,300,000	52%	\$0	0%	\$1,300,000	20%
	Equity	\$694,544	28%	\$1,934,986	49%	\$2,629,530	41%
	MNCIFA Loan	\$500,000	20%	\$2,000,000	51%	\$2,500,000	39%
Total Sources		\$2,494,544	100%	\$3,934,986	100%	\$6,429,530	100%
Uses	Equipment	\$1,301,200	52%	\$2,620,000	67%	\$3,921,200	61%
	Utilities	\$56,000	2%			\$56,000	1%
	Site Prep	\$35,000	1%			\$35,000	1%
	Hydraulic Drive	\$7,800	0%			\$7,800	0%
	'25 & '26 Site Labor	\$217,500	9%	\$333,000	8%	\$550,500	9%
	'25 & '26 Site Ops	\$477,044	19%	\$381,986	10%	\$859,030	13%
	Corporate Engineering	\$400,000	16%	\$600,000	15%	\$1,000,000	16%
Total Uses		\$2,494,544	100%	\$3,934,986	100%	\$6,429,530	100%

*PRI: The Schmidt Family Foundation (majority) and other Foundations

Financial Analysis:

The financial analysis is based on unaudited financials of Carba Inc. on project cash flows over the 5-year term.

- Debt-to-Equity: 0.58
- Debt Coverage Ratio:
 - 2026: -1.94
 - 2027: 1.95
 - 2028: 2.38
- Risk Rating: 3
- Scoring Framework: 62

Collateral:

The primary collateral for the loan will be capital equipment acquired through planned CapEx investments. This includes machinery and other tangible fixed assets that will be purchased and deployed as part of our operational expansion. These assets are durable, clearly identifiable, and can be valued to support the loan facility. MnCIFA understands that the collateral may not have much value and has priced the risk into its evaluation.

Risk:

1. Contract Performance Risk

- The Microsoft contract for 44K carbon credits requires the first credits to be delivered Q4 2025 and quickly ramping up to large volumes in Q3 and Q4 2026.
- Delays could trigger penalties, renegotiation or contract cancellation
- **Risk Mitigation:** We have a buffer built into the overall delivery numbers to account for uncertainty and we negotiated lower delivery commitment minimums for the first 3 quarters of production.

2. Technology Scale-up Risk:

- Transitioning from successful pilots to multiple commercial units may face operational challenges in maintaining consistent quality and efficiency across the deployments
- **Risk Mitigation:** One year of R&D pilot testing provides the foundation for reliable scale-up. Carba's founding advisor brings proven experience successfully scaling processing operations from pilot to commercial stage. We recently hired an experienced COO who has led business and technical teams delivering new products to markets including automotive, aerospace, medical devices, semiconductor and factory automation.

Other Risk Mitigants for MnCIFA:

- Multiple funding sources: DOE grant, PRI funds, investor round in process
- Microsoft contract demonstrates market validation and a committed early revenue stream
- Financials exclude DOE grant; Forecasts rely on alternative funding sources. If DOE funding comes through, that will be upside for the project.
- Diversified capital structure reduces lender exposure

Loan Terms:

- 5 year term, with a 5-year amortization schedule, with funding expected August 1, 2025
 - The MnCIFA staff has determined that the interest rate for this loan will be the 5 year Treasury rate a week before closing and a minimum of 175 basis points adder, not to exceed 190 basis points.
 - Interest will start to accrue on August 1, 2025. The accrued interest from August 1, 2025 through July 1, 2026 will be added to the principal amount.
- Principal and interest payments will begin no later than July 1, 2026, with the final payment taking place June 1, 2030.
- Carba Inc. will pay a \$10,000 origination fee to cover the cost of legal fees for MnCIFA.

Workforce:

- Prevailing wages will need to be paid and reported.
- Approximately 7 FTEs construction jobs: Direct labor: Four engineering, one office manager, two tech/operators.
- An additional 6 permanent FTE jobs at full scale 4 reactors.

Energy Savings:

- CO2 emissions reduction of 30,000 MT CO₂/year

Recommendation:

- It is recommended that the Board of MnCIFA authorize the execution of loan documents, with Carba Inc. for a loan not to exceed \$500,000 and to authorize the transfer of funds if all covenants are met.