



Environment and Natural Resources Trust Fund

2025 Request for Proposal

General Information

Proposal ID: 2025-297

Proposal Title: Minnesota Roads CO2 Capture Using Carba Pyrolysis Technology

Project Manager Information

Name: Andrew Jones

Organization: Carba

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Project Basic Information

Project Summary: This proposal demonstrates and assesses the use of biomass-derived charcoal in Minnesota road construction layers to improve road properties, robustness and carbon sequestration.

ENRTF Funds Requested: \$250,000

Proposed Project Completion: June 30, 2027

LCCMR Funding Category: Small Projects (H)

Secondary Category: Air Quality, Climate Change, and Renewable Energy (E)

Project Location

What is the best scale for describing where your work will take place?

Statewide

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Narrative

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

The proposal addresses the critical need for sustainable and resilient road construction materials, particularly in the face of climate change and the demand for environmental conservation and fossil-fuel alternatives. Recent lab-scale research has highlighted the potential of charcoal as an additive to improve the properties of subsurface asphalt pavements, focusing on factors such as the additive's percentage and particle size. However, the application of charcoal on a larger scale and its effects on different asphalt pavement layers remain under-explored.

Furthermore, the impact of charcoal-enhanced asphalt in cold weather conditions, which are prevalent in regions like Minnesota, has not been thoroughly investigated. This gap presents a significant opportunity for innovation in road construction practices that could lead to improved durability and reduced environmental impact.

Our proposal leverages Carba's reactor technology to convert waste wood chips into stable, fine carbon at low temperatures and rapidly without the need for post-processing. This advancement not only promotes waste material reuse but also provides a consistent, eco-friendly supply of charcoal for asphalt production as an alternative to fossil-derived asphaltenes. The project aims to bridge the research gap by studying the comprehensive effects of charcoal in asphalt pavement across various layers and under cold weather conditions,

What is your proposed solution to the problem or opportunity discussed above? Introduce us to the work you are seeking funding to do. You will be asked to expand on this proposed solution in Activities & Milestones.

To address the identified need for durable, sustainable, and cold-resistant asphalt pavement, our proposed solution involves an extensive investigation into the use of Carba reactor-produced charcoal as an innovative additive. This charcoal, derived from waste wood, offers a sustainable and environmentally friendly way to enhance road construction materials without the need for post-processing. We aim to explore its application across various asphalt pavement layers and assess its performance in cold weather conditions.

Our project seeks funding to conduct a series of comprehensive studies, including laboratory tests and field trials, to evaluate the effects of charcoal on asphalt's strength, durability, and resistance to cold weather-induced cracking. We will focus on optimizing the charcoal's type, size, and percentage within the asphalt mixture to maximize benefits while ensuring economic feasibility.

The funding will support the development of new mix designs, testing protocols, and the execution of pilot projects in Minnesota's diverse climate. By validating the practical benefits of our approach, we aim to establish a new standard for road construction that not only meets the challenges of climate change but also contributes to carbon sequestration and waste reduction. This work lays the groundwork for future scalable applications and advancements in sustainable infrastructure.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

The project aims to optimize Carba reactor-produced charcoal use in road construction, enhancing durability and sustainability. It will identify the ideal charcoal type for various layers and the optimal size and percentage for cold resilience. This research includes studying charcoal degradation in different layers through accelerated anaerobic tests, correlating with the percentage of asphalt. Efforts will reduce maintenance, extend road life, and integrate sustainable materials, contributing to environmental stewardship. Understanding charcoal's impact on road properties and its carbon sequestration capability supports the state's commitment to natural resource conservation and sustainable infrastructure.

Activities and Milestones

Activity 1: Charcoal Optimization for Asphalt Enhancement Title: Charcoal Optimization via Carba Reactor for Road Use

Activity Budget: \$70,000

Activity Description:

The objective is to optimize charcoal produced at various pyrolysis conditions (temperature, particle size, steam, oxygen, speed) using local waste biomass, evaluating its suitability for road construction. We'll conduct a Life Cycle Assessment (LCA) and Techno-Economic Analysis (TEA), analyze effects of mixing time on particle size, and assess chemical properties. These steps aim to identify the most environmentally and economically viable charcoal types for road materials, enhancing sustainability and performance. Outcomes will influence the selection of charcoal for further testing in road layer applications. Evaluation will compare LCA and TEA results to select optimal charcoal types.

Activity Milestones:

Description	Approximate Completion Date
Complete charcoal production at different temperatures	September 30, 2025
Finalize LCA and TEA analysis	December 31, 2025
Determine optimal charcoal types for road construction	March 31, 2026

Activity 2: Charcoal-Enhanced Asphalt Testing for Road Layers Title: Testing Charcoal-Enhanced Asphalt for Road Durability

Activity Budget: \$100,000

Activity Description:

This activity involves integrating optimized charcoal into asphalt for subbase, base, and surface layers, conducting CBR tests for subbase/base layers, and Marshall stability tests for surface layers. The goal is to determine the ideal charcoal mix that improves road durability and weather resistance. Successful outcomes include established mix designs for each layer, potentially reducing road maintenance and enhancing lifespan. The evaluation will compare results to standard performance benchmarks for optimal mix selection.

Activity Milestones:

Description	Approximate Completion Date
Optimize charcoal mix for subbase layer	June 30, 2026
Determine ideal charcoal mix for base layer	August 31, 2026
Establish charcoal mix for surface layer	November 30, 2026

Activity 3: Pilot Road Construction with Charcoal Asphalt Title: Pilot Construction and Evaluation of Charcoal-Enhanced Road

Activity Budget: \$80,000

Activity Description:

Following lab testing, a 10'x10' road section will be constructed in Saint Paul using optimized charcoal asphalt, including control sections for comparative analysis. Accelerated anaerobic testing and performance tests (Superpave Gyrotory Compactor, Wheel-Tracking) will predict long-term performance and demonstrate practical benefits. Objectives include

validating charcoal asphalt's effectiveness in real-world conditions, guiding future implementations. Outcomes aim to showcase enhanced road quality and environmental benefits, supporting sustainable infrastructure development.

Activity Milestones:

Description	Approximate Completion Date
Begin construction of the pilot road(10'x10')	February 28, 2027
Complete accelerated anaerobic testing	April 30, 2027
Finish initial performance analysis and comparison	June 30, 2027

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this work be funded?

Upon completion, results will lead to the construction of a section of road, showcasing the practical application of our findings. This pilot project will serve as a prototype for wider implementation across Saint Paul, utilizing the sustainable and durable qualities of our innovative asphalt mix. Future efforts and additional research aimed at refining road construction techniques with charcoal will be pursued with larger funding opportunities through municipal and federal sources. The construction of a road based on these results is anticipated to be supported by Saint Paul, following thorough analysis and validation.

Project Manager and Organization Qualifications

Project Manager Name: Andrew Jones

Job Title: CEO

Provide description of the project manager's qualifications to manage the proposed project.

As the proposed project manager, I bring a rich tapestry of experiences and skills to the table, garnered from my journey as an entrepreneur, engineer, scientist, and inventor. Founding Activated Research Company (ARC) has been a testament to my entrepreneurial spirit, where I've cultivated a thriving innovation firm focused on advancing analytical technology. This venture has equipped me with a deep understanding of project management, from inception to commercialization.

My engineering background lays a robust foundation for overseeing the technical aspects of the proposed project. I possess the technical acumen necessary to navigate complexities, ensuring the seamless implementation of solutions while effectively addressing any engineering challenges that may arise.

Moreover, my scientific background, forged through developing analytical technologies at ARC, provides me with a nuanced understanding of the project's scientific objectives. This enables me to align our goals with scientific principles, ensuring that our endeavors yield meaningful and impactful results.

My inventive mindset, as evidenced by the patents I hold, underscores my capacity for creative problem-solving. I am adept at thinking outside the box and devising innovative solutions to overcome obstacles, propelling the project forward with ingenuity and determination.

Furthermore, my receipt of esteemed accolades such as the Neil Armstrong Award of Excellence and R&D100 serves as a testament to my leadership prowess and recognized achievements in the field.

In essence, my multifaceted background as an entrepreneur, engineer, scientist, and inventor uniquely positions me to steer this project toward success. With my entrepreneurial drive, technical expertise, scientific insight, inventive thinking, and acclaimed achievements, I am confident in our ability to deliver exceptional results and make a lasting impact.

Organization: Carba

Organization Description:

Carba Technologies, a leading force in carbon dioxide removal (CDR), stands at the forefront of environmental sustainability. Our mission is deeply rooted in combating climate change with innovative solutions that address the

urgent need for carbon reduction. Our flagship technology, an advanced carbon dioxide removal system, exemplifies this commitment. Utilizing a unique pyrolysis process, we convert biomass into biochar, a stable carbon form, effectively sequestering CO₂ from the atmosphere. This not only mitigates greenhouse gas impacts but also generates renewable energy and bio-oil, contributing to a circular economy.

Our partnership with Waste Management (WM) showcases our dedication to leveraging collaborations for environmental benefits. We're developing biochar applications in road construction, exemplifying practical carbon sequestration that complements our technological innovations.

Carba Technologies is a movement toward a sustainable future, driven by rigorous scientific research and a commitment to excellence. Our dynamic team of experts and a clear vision guide us, addressing today's challenges and paving the way for a cleaner, greener tomorrow. Our approach is global, aiming to implement scalable solutions for significant impact.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
R&D and Lab Staff		Carry out the experiment, identify subsequent actions, and compile a report.			20%	0.8		\$105,600
R&D		Analyze the results, prepare the report, and discuss the next steps.			20%	0.1		\$18,000
							Sub Total	\$123,600
Contracts and Services								
Carba	Internal services or fees (uncommon)	Different tests for evaluating the strength of the asphalt after adding charcoal from Carba, and also the slab test on a large scale				66,400		\$66,400
Carba	Internal services or fees (uncommon)	The materials needed for producing charcoal and also for making the different asphalt layers.				20,000		\$20,000
Normec OWS	Professional or Technical Service Contract	Accelerated anaerobic test on charcoal at different layers of asphalt				40,000		\$40,000
							Sub Total	\$126,400
Equipment, Tools, and Supplies								
							Sub Total	-
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-

Travel In Minnesota								
							Sub Total	-
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-
Other Expenses								
							Sub Total	-
							Grand Total	\$250,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
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Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	-
Non-State				
			Non State Sub Total	-
			Funds Total	-

Total Project Cost: \$250,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [a6cc5182-e17.pdf](#)

Alternate Text for Visual Component

The visual likely depicts the Carba process, which converts waste wood chips into a stabilizing charcoal used in asphalt pavement layers to enhance durability....

Financial Capacity

Title	File
Financial Capacity Note	b357e5c2-18e.pdf

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
Support Letter	d0b950c4-79f.pdf
non-state_entity_resolution_letter_	f20f8a8f-d50.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Does your project have potential for royalties, copyrights, patents, sale of products and assets, or revenue generation?

Yes

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

Yes

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

No

Does your project include original, hypothesis-driven research?

Yes

Does the organization have a fiscal agent for this project?

No

Does your project include the pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing \$10,000 or more or large-scale stream or wetland restoration?

No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services (as defined in Minnesota Statutes section 299C.61 Subd.7 as "the provision of care, treatment, education, training, instruction, or recreation to children")?

No

Provide the name(s) and organization(s) of additional individuals assisting in the completion of this proposal:

NA