AmeriCarbon

April 1, 2024

State of North Dakota
The Industrial Commission
State Capitol
Bismarck, ND 58505
ATTN: Lignite Research Program

RE: Transmittal Letter

This transmittal letter is to set forth a binding commitment on behalf of AmeriCarbon Products, LLC to complete the project as described in the accompanying application if the North Dakota Industrial Commission makes the grant requested therein.

Sincerely,

Greg Henthorn
Vice President of Corporate Development
AmeriCarbon Products, LLC

THIS DOCUMENT HAS A COLORED BACKGROUND AND MICROPRINTING. THE REVERSE SIDE INCLUDES AN ARTIFICIAL WATERMARK.

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(888) 367-1650

Clear Mountain Bank
PO Box 205
39 Union Street
Bruceton Mills, WV 26525

No. 1901

69-259/515

Date 4/1/2024

Pay To The Order Of State of North Dakota **$** **100.00

One Hundred and 00/100 **Dollars**

Memo: Application Fee

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1901 **Amount: $100.00** **Date: 4/1/2024**

Pay to: State of North Dakota

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Pay to: State of North Dakota

Submitted To: State of North Dakota
The Industrial Commission
State Capitol
Bismarck, ND 58505
ATTN: Lignite Research Program

Project Title: Lignite Conversion Reactor Optimization for Commercial Carbon Pitch Manufacturing

Applicant: AmeriCarbon Products, LLC

Principal Investigator: David A. Berry

Date of Application: April 1, 2024

Amount of Request: $743,809

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1. Abstract

The United States is dependent on China for a number of critical materials and supplies that place our nation's economic and defense security at risk. Advanced carbon materials – possessing properties such as possessing high strength-to-weight ratio, flexibility, electrical conductivity, thermal control, chemical resistance, and radar absorption – are playing an increasingly critical role in a number of sectors, including national defense, infrastructure, energy storage, and transportation.

Ironically, the United States is rich in carbon deposits in the form of coal. However, the current industrial process for producing coal tar and coal tar pitch, intermediate forms required to unlock coal's potential for advanced materials applications, is exclusively a ~5% by-product of coking ovens used in steelmaking. Because the United States' steel production capacity has been decimated since the 1980s, our nation's supply chains are unnecessarily dependent on China and other Asian countries for coal tar and coal tar pitch, leaving our national security vulnerable to manipulation and dependence. A major supply shortfall in coal tar pitch has emerged, with market prices increasing approximately 50% in the past year alone; projections suggest these dynamics will only increase for the foreseeable future.

With substantial support from the State of North Dakota and The North American Coal Corporation, AmeriCarbon is at the forefront of efforts to mitigate the carbon materials supply crisis by accelerating the commercial adoption of Eco-Pitch™, an alternative to China-derived coal tar pitch, which will be manufactured in North Dakota using an alternative chemical pathway that does not rely on steel manufacturing. Instead, AmeriCarbon's patented and proprietary non-combustible process uses lignite coal as its primary feedstock, with the flexibility to use different types of coal and the capacity to tailor its operating conditions to produce multiple formulations of its end products to meet specifications for different applications.

AmeriCarbon is entering into its final stage of commercial engineering design & scaleup for its proprietary Liquid Carbon Process to manufacture Eco-Pitch™. Through its numerous internal studies and design efforts, AmeriCarbon has identified an optimized reactor configuration that incorporates specific operational benefits for lignite coals. Prior supported efforts by NDIC, in partnership with North American Coal, have led to valuable insights through the successful conversion of lignite coal into specialty pitches, asphalt, and graphite. These insights will be incorporated into the improved design of an optimized reactor that will be utilized in our planned commercial plant to be located in North Dakota. Within this scope, this innovative reactor will be validated and will generate a variety of lignite-based pitches that will be shared with AmeriCarbon's customer base to generate feedback and expand market base for lignite coal. The proposed $1,488,809 project (including $743,809 requested from NDIC) will span 18 months upon initiation and involves the following primary participants: AmeriCarbon Products, LLC (applicant), Worley

Parsons, and The North American Coal Corporation, which have collectively pledged $745,000 in cost share.

2. Project Summary

AmeriCarbon is working to design, construct, and operate a commercial scale carbon products manufacturing facility in McLean County, North Dakota ("McLean Plant"). The McLean Plant will use North Dakota lignite in AmeriCarbon's patented and proprietary Liquid Carbon Process to manufacture *Eco-Pitch*™, a 100% domestically sourced alternative to coal tar pitch, a critical supply material for the production of synthetic graphite, asphalt binder, and other carbon materials.

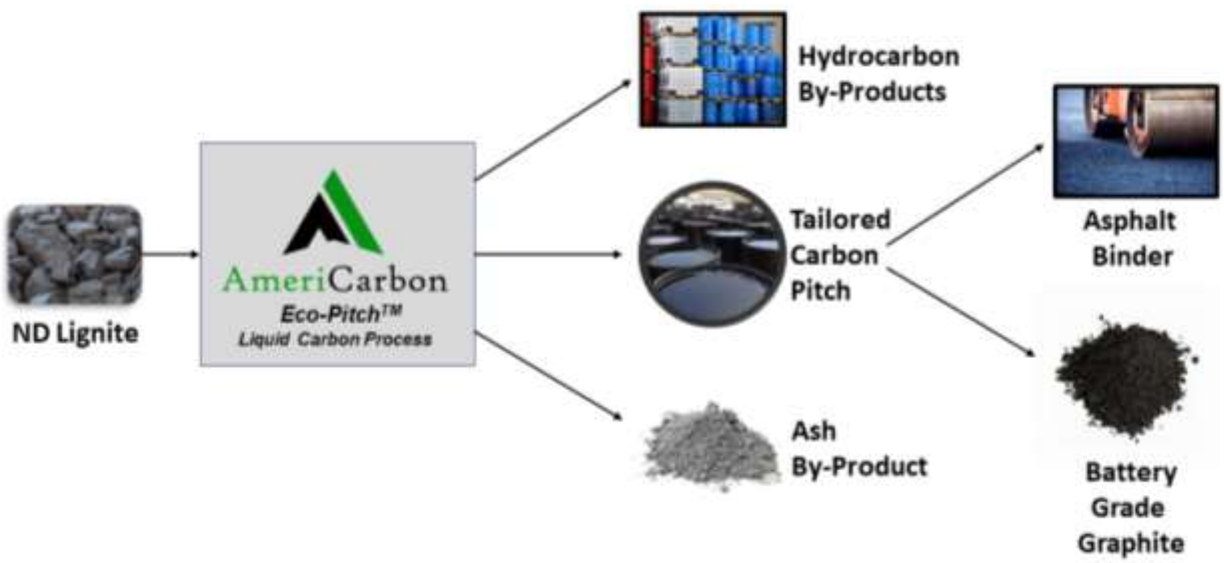

Figure 1. *Simplified overview of AmeriCarbon's Liquid Carbon Process.*

Comprising more than a dozen unit operations, AmeriCarbon's Liquid Carbon Process employs predominantly off-the-shelf, proven technologies. This approach leverages existing, proven methodologies to ensure operational efficiency, scalability, and cost-effectiveness. Having completed our third stage of engineering design (FEL2), AmeriCarbon has identified the conversion reactor as a critical area for enhancement to optimize the efficiency and cost effectiveness of the overall process. **This project is to optimize the commercial reactor design of the Liquid Carbon Process that will be used in the McLean Plant.**

The project will entail the following tasks (further detailed in the Project Description section):

- TASK 1: Analysis of AmeriCarbon Concept/Prototype Reactor Design
- TASK 2: Identify/Develop Reactor Preliminary Design Specifications
- TASK 3: Engineering Analysis and Prototype Design
- TASK 4: Fabricate, Install and Commission Prototype Reactor
- TASK 5: Generate Lignite-Based Pitch Material with Prototype Reactor

Based on work performed to date, AmeriCarbon has developed a preliminary design for the conversion reactor. To complete the project, AmeriCarbon will contract with Worley Parsons, a global engineering, procurement, and construction (EPC) company specializing in providing innovative solutions for complex projects across various industries, including energy, resources, and infrastructure. After creating the modified reactor, a range of lignite coal-derived pitches will be made in AmeriCarbon's pilot manufacturing facility using the prototype reactor to validate its efficacy. These pitch samples will be distributed to prospective customers and collaborators for feedback and evaluation.

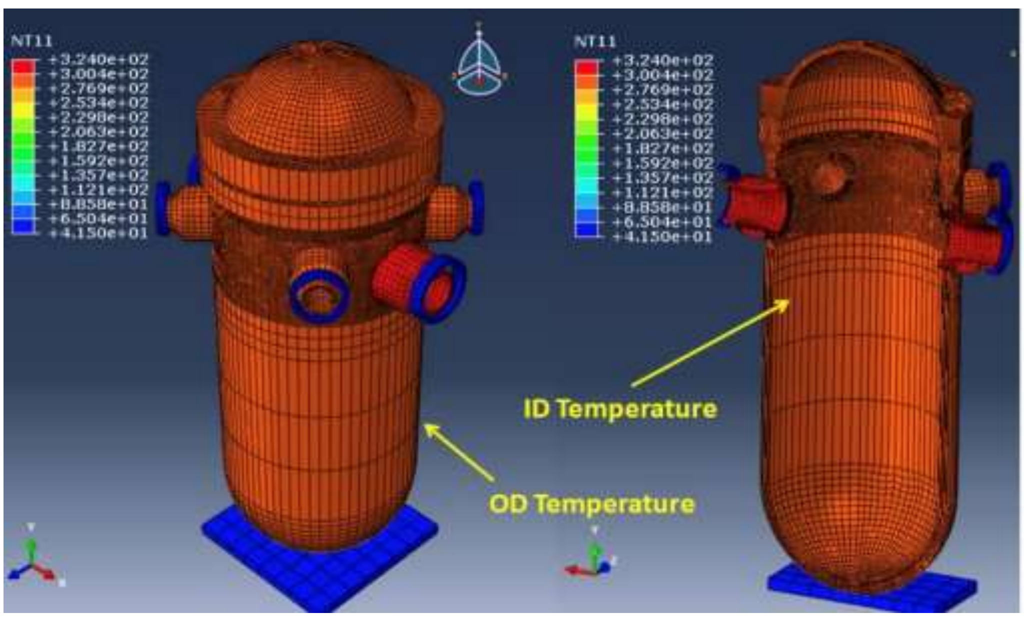

Figure 2. *Hypothetical reactor illustration (stock image only).*

<u>Optimization of the reactor is imperative for integrating lignite processing seamlessly into AmeriCarbon's base module design.</u> Lignite presents unique coal conversion differences, such as extensive volatile gas formation relative to other coal types, which must be addressed to harness the distinctive beneficial carbon structures inherent in lignite. By optimizing the reactor, AmeriCarbon can overcome these challenges and ensure the efficient utilization of lignite in its processes. This project will not only enhance operational efficiency but will facilitate the seamless integration of the lignite conversion reactor into AmeriCarbon's base module design.

The overall objectives of this project are as follows:

1. Optimizing the commercial engineering design and scale-up of AmeriCarbon's Liquid Carbon Process to manufacture Eco-Pitch™, utilizing an optimized reactor configuration tailored for lignite coals.

2. Incorporating insights from previous NDIC-supported efforts to successfully convert lignite coal into specialty pitches, asphalt, and graphite into the improved design of the optimized reactor.

3. Validating the innovative reactor design and generating a variety of lignite-based pitches to expand the market base for North Dakota lignite coal.

4. Strengthening the domestic production capabilities of critical carbon materials, reducing reliance on foreign sources, and enhancing economic and defense security in the United States.

5. Enhancing customer feedback mechanisms and market viability for Eco-Pitch™ and other lignite-based products, fostering economic growth and job creation in North Dakota's lignite industry.

In summary, the project aims to optimize the commercial reactor design of AmeriCarbon's Liquid Carbon Process, enhancing domestic production capabilities, strengthening economic security, and expanding the market for North Dakota lignite coal.

3. Project Description

Project Objectives

As stated in the Project Summary section, the overall objectives of this project are the following:

1. Optimizing the commercial engineering design and scale-up of AmeriCarbon's Liquid Carbon Process to manufacture Eco-Pitch™, utilizing an optimized reactor configuration tailored for lignite coals.

2. Incorporating insights from previous NDIC-supported efforts to successfully convert lignite coal into specialty pitches, asphalt, and graphite into the improved design of the optimized reactor.

3. Validating the innovative reactor design and generating a variety of lignite-based pitches to expand the market base for North Dakota lignite coal.

4. Strengthening the domestic production capabilities of critical carbon materials, reducing reliance on foreign sources, and enhancing economic and defense security in the United States.

5. Enhancing customer feedback mechanisms and market viability for Eco-Pitch™ and other lignite-based products, fostering economic growth and job creation in North Dakota's lignite industry.

Critical Need / Technological and Economic Impacts

The optimization of the reactor is vital for seamlessly integrating lignite processing into AmeriCarbon’s base module design. Lignite’s material properties pose distinctive challenges, notably the significant volatile gas formation/evolution, necessitating solutions to harness lignite's unique structures effectively. By optimizing the reactor for lignite conversion, AmeriCarbon’s Liquid Carbon Process can overcome these obstacles to unlock the unique material properties of lignite, ensuring the efficient utilization of lignite in the carbon materials supply chain. This project will not only bolster operational efficiency of the reactor itself, but also streamline the integration of the lignite conversion reactor into AmeriCarbon's base module design, contributing to a cohesive and efficient manufacturing process.

More broadly, AmeriCarbon's efforts to onshore the production of critical carbon materials such as coal tar pitch and graphite carries significant national security and geopolitical implications. These materials serve as essential components in various industries critical to national defense, infrastructure, energy storage, and transportation. Currently, the United States heavily relies on imports, particularly from China, for these materials, leaving its supply chains vulnerable to global tensions and disruptions. By establishing domestic production capabilities for coal tar pitch and graphite, AmeriCarbon is not only contributing to the nation's economic resilience but also helping to reduce its dependence on foreign sources for strategic materials. This strategic shift towards onshoring production aligns with broader efforts to bolster national security by securing essential supply chains and ensuring a reliable and uninterrupted supply of critical carbon materials essential for defense and industrial applications. By mitigating supply chain risks and strengthening domestic manufacturing capacity, AmeriCarbon's commercial efforts (including the planned McLean Plant) help to safeguard the nation's security interests and promote economic sovereignty.

Current Industrial Reliance on Coking Ovens

The supply chain for coal tar pitch is characterized by its critical dependence on coal tar, a by-product derived from the coking process in steel manufacturing blast furnaces, constituting a by-product that is approximately 5% of the total output. However, the dominance of steel production by China, Russia, and other Asian countries underscores the vulnerability of the global coal tar pitch supply chain. In the United States, the steel industry experienced a significant decline in the 1970s and 1980s, resulting in a steep reduction in domestic capacity. Moreover, with the majority of U.S. steel production now reliant on recycled materials rather than coking ovens, the availability of domestic coal tar has dwindled to near-negligible levels, further exacerbating the challenge of sourcing coal tar pitch domestically.

Figure 3 shows China's dominance in steel manufacturing, which (prior to the scaling of AmeriCarbon's alternative approach) translates to China's dominance in the supply chain for advanced carbon materials.

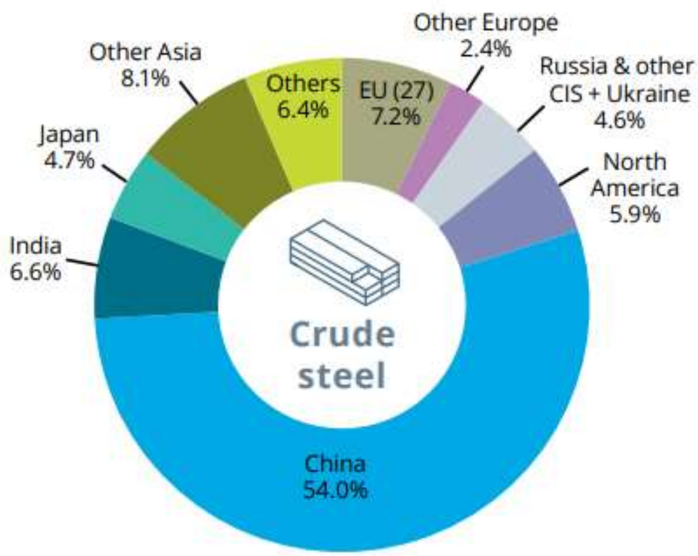

Figure 3. *China dominates world crude steel production, leading to dominance in carbon supply chains. (Source: 2023 World Steel in Figures, World Steel Association, 18 May 2023)*

The dynamic gets worse, however, for U.S. carbon supply chains. The blast furnace manufacturing method, utilizing coking ovens, is the process that produces coal tar as a by-product, unlike other methods which do not yield coal tar. Projections indicate a notable decrease in the utilization of the blast furnace method in the future (due to environmental concerns, among other things), further tightening the supply of coal tar. Meanwhile, the Electric Arc Furnace method – one of the primary alternatives to the blast furnace method of steelmaking – actually *consumes* substantial volumes of coal tar pitch (instead of producing coal tar as a by-product), exacerbating the increasing supply and demand imbalance for coal tar and coal tar pitch.

The looming supply / demand crisis in coal tar pitch was the primary driver in AmeriCarbon's entry into the market. We have targeted a manufacturing capacity of approximately 30,000 tons per year (measured in coal feedstock) for our base pitch manufacturing module, which represents an approximate 10x scaleup of our pilot manufacturing facility (described elsewhere herein). According to our research,[1] AmeriCarbon could construct approximately 20 to 25 base modules of the size planned for the McLean Plant over the next few years, just to keep up with the incremental growth in demand compared to a projected flat supply.[2] By 2029, this shortfall is estimated to be 500,000 tons in North America alone, which would require approximately 35 AmeriCarbon modules to match the incremental growth in demand (Figure 4). The estimated global shortfall is 4.5 million tons by 2029, based on management estimates using data from Market Insights and Benchmark Week 2022.

[1] Management estimates using data from Market Insights and Benchmark Week 2022
[2] Our assumption for flat supply does not factor in the projected decline in use of blast furnace method, likely underestimating the shortfall for coal tar pitch supply, nor the prospect that China and other producers of coal tar will consume their coal tar pitch to make higher value products.

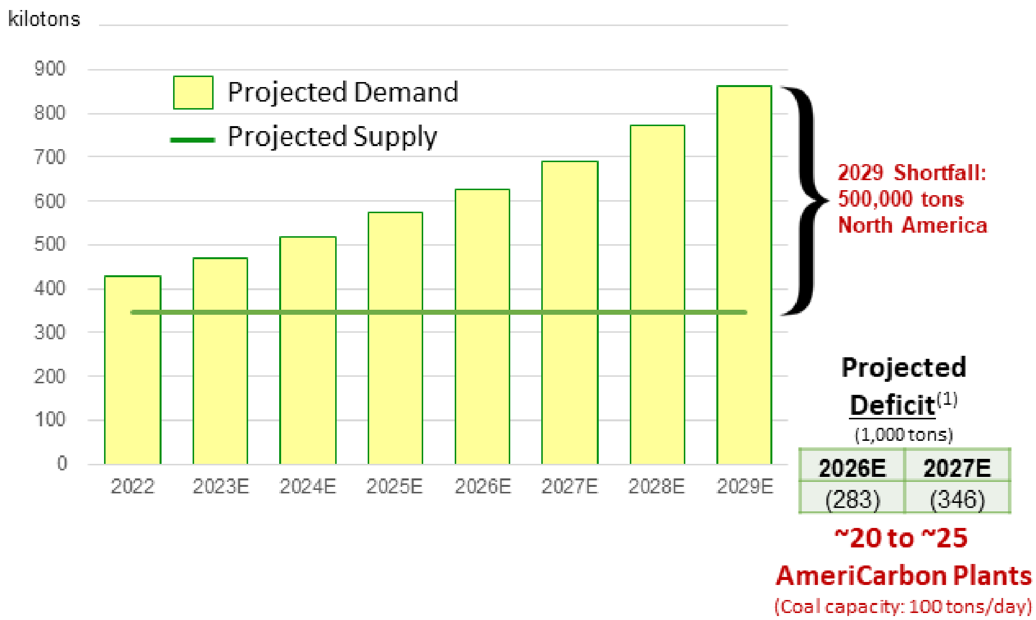

Figure 4. *The United States has begun facing a major supply shortage for coal tar pitch.*

With rapidly growing demand for advanced carbon products and dwindling supply, what are the solutions? Additional coking ovens will not be constructed to produce a ~5% by-product. One idea would be to replace a small subset of applications that currently require coal tar pitch and seek to use petroleum-based pitch as a replacement. This may work in certain instances, but petroleum pitch supply does not come in abundance, and has its own set of environmental concerns and unfavorable domestic supply / demand curve dynamics.

The other consideration – which is the one AmeriCarbon has been pursuing since 2020 – is the development of an alternative chemical pathway to produce coal tar pitch. However, to do so requires a pilot manufacturing facility that would cost ~$20 million to design and construct, and require several years to design, build, and learn how to operate. This puts AmeriCarbon and its collaborators – and the McLean Plant – in pole position to help our nation address these concerning supply chain dependencies. **<u>The currently proposed project is on the critical path to entering the coal tar pitch market as a scalable solution.</u>**

Project Methodology / Statement of Work

The project methodology outlines a comprehensive approach to optimize AmeriCarbon's reactor design for lignite coal processing, comprising a series of tasks executed in collaboration with Worley. These tasks encompass a thorough analysis of the existing reactor design, identification of operational parameters, engineering analysis, prototype design, fabrication, installation, and commissioning. The ultimate goal is to generate lignite-based pitch materials with enhanced performance characteristics, validating the effectiveness of the optimized reactor design and advancing AmeriCarbon's mission of onshoring critical carbon material production.

TASK 1: Analysis of AmeriCarbon Concept/Prototype Reactor Design – A thorough concept design review and analysis of the AmeriCarbon reactor will be conducted to evaluate both process and mechanical constraints for optimization of lignite coal processing. This will include, but not be limited to:

- Operating pressures / temperatures
- Process operability requirements
- Heat transfer and flow requirements / limitations of design
- Materials of construction (MOC) requirements
- Fabrication complexities / requirements

The output from this task will inform activities in Task 2. *(Performers: AmeriCarbon/Worley)*

TASK 2: Identify/Develop Reactor Preliminary Design Specifications – Operational parameters will be identified and factored into preliminary design specifications for the optimized reactor. Targeted experimental reaction studies utilizing lignite coal will be conducted at AmeriCarbon's pilot manufacturing facility to inform necessary specification details. The design and throughput of the prototype reactor to be built and demonstrated will be based on the current AmeriCarbon pilot facility and concomitant integration into the Liquid Carbon Process. *(Performers: AmeriCarbon/Worley)*

TASK 3: Engineering Analysis and Prototype Design – Analysis of the new AmeriCarbon reactor will be conducted that may include, but not be limited to: flow studies, heat and mass transfer, structural, thermal stress, etc. These analyses will establish the initial design basis that will result in development of fabrication drawings, including all test/certification requirements for its construction. *(Performers: AmeriCarbon/Worley)*

TASK 4: Fabricate, Install and Commission Prototype Reactor – Per the design and fabrication drawings developed in Task 3, the prototype reactor will be fabricated and installed in the AmeriCarbon pilot facility. A number of testing procedures will be conducted to commission the reactor for safe pilot operations and verify effective operability range. *(Performers: AmeriCarbon/Worley)*

TASK 5: Generate Lignite-Based Pitch Material with Prototype Reactor – A variety of pitches made from lignite coal will be processed with the new prototype reactor to further validate its performance. Further, these pitch materials will be sent to existing AmeriCarbon customers/collaborators for feedback and continuous customer development such as the University of North Dakota, defense contractors, and carbon materials manufacturers. *(Performer: AmeriCarbon)*

Anticipated Results

AmeriCarbon seeks the following results from the proposed project:

- **Optimized Reactor Design.** Through thorough analysis and engineering efforts, AmeriCarbon anticipates achieving an optimized reactor design tailored in a manner to enable the optimal processing of lignite coal. This optimized design will address unique challenges such as the formation of gas pockets due to volatiles, ensuring efficient utilization of lignite while maximizing operational efficiency.
- **Enhanced Process Performance.** The implementation of the optimized reactor design is expected to result in enhanced process performance, including improved heat transfer, flow dynamics, and materials of construction (MOC) compatibility. This enhancement will enable AmeriCarbon to

overcome existing process limitations and leverage the unique structures present in lignite for the production of tailored and advanced carbon materials.

- **Streamlined Integration.** By dovetailing the lignite reactor into the base module design, AmeriCarbon aims to streamline integration efforts and improve uniform operation with its existing manufacturing processes. This integration will facilitate a more efficient production workflow and minimize downtime associated with reactor modifications or retrofits.
- **Market Expansion and Customer Satisfaction.** The successful optimization of the reactor design will enable AmeriCarbon to expand its market base for lignite-derived products, including Eco-Pitch™ and other carbon materials. By generating lignite-based pitches with improved performance characteristics, AmeriCarbon anticipates attracting new customers and collaborators while satisfying the needs of existing partners, including defense contractors, carbon materials manufacturers, and academic institutions.
- **Economic and Environmental Benefits.** AmeriCarbon expects the optimized reactor design to yield significant economic benefits by reducing production costs, enhancing product quality, and increasing overall competitiveness in the carbon materials market. Additionally, by utilizing lignite, an abundant and domestically sourced resource, AmeriCarbon aims to contribute to regional economic development while minimizing environmental impact through sustainable resource utilization practices.
- **Advancement Toward Commercialization.** The successful optimization of the reactor design represents a crucial milestone in AmeriCarbon's progress toward the commercial development and finance of the McLean Plant. By demonstrating the feasibility and efficacy of its technology at scale, AmeriCarbon will be better positioned to attract private investment, secure partnerships, and advance toward the realization of a commercially viable lignite processing facility.

Overall, AmeriCarbon anticipates that the optimization of the reactor design will not only strengthen its position as a leader in carbon materials innovation but also enable additional beneficial use cases for lignite.

Facilities & Equipment

The project will be conducted at existing facilities that are operated by the project's performers. The facilities are outlined below.

AmeriCarbon Research and Pilot Demonstration Facility

Figure 5: *AmeriCarbon's Research and Pilot Demonstration Facility in Morgantown, West Virginia.*

AmeriCarbon operates a state-of-the-art 12,000 sq-ft facility in the Morgantown Industrial Park (Morgantown, West Virginia) that contains infrastructure for laboratory through pilot-scale R&D. The facility contains six commercial flame suppression laboratory hoods and a wet chemistry area along with multiple high-bay areas for pilot-level research and demonstration.

Figure 6: *AmeriCarbon's pilot scale unit operations that underpin the LCP process.*

AmeriCarbon Equipment

Figure 7: *AmeriCarbon's pilot scale and research equipment.*

AmeriCarbon's equipment includes: coal liquefaction & coker trains capable of processing 10 tons per day; capable of producing custom coal pitch, needle coke, and advanced carbon products; product separation and collection train; both trains are fully automated and managed by an industry standard computer / software system; six commercial hood laboratory with flame suppression and exhaust system; fully equipped for benchtop lab research and development. The facility is heavily instrumented and managed by a PLC control system with continuous monitoring.

Environmental and Economic Impacts of the Project

With respect to the conduct of the proposed project, environmental impact will be minimal. Existing facilities will be used. The facilities used in the project will operate within reasonable parameters of waste and energy consumption that are consistent with their current usage levels.

In terms of immediate economic impact, the project budget of $1,488,809, which includes cost share of $745,000, includes $280,000 to Worley Parsons and its contractors. Success of the project will contribute to the establishment of the McLean Plant, projected to result in several tens of millions of dollars of investment and the creation of 40-70+ long term jobs.

Future environmental impacts are also significant. *Eco-Pitch*™ is a quantum leap forward in terms of improved environmental impact compared to current supplies. Due to AmeriCarbon's efficient and non-combustible low temperature process, greenhouse gas emissions are reduced by more than 92% compared to coal tar pitch produced as a by-product of coking ovens in the steelmaking process (Downstream Strategies, 2021 and 2023). Further, because AmeriCarbon's process operates at lower temperatures, certain carcinogenic compounds and other harmful chemicals are not generated in the process.

4. Standards of Success

The project aims to bolster the domestic production of advanced carbon products, a strategic sector in the United States poised for substantial growth. Leveraging lignite coal as a primary raw material, AmeriCarbon and its collaborators seek to onshore the supply chain for advanced carbon material applications, enabling the creation of valuable finished products while dramatically reducing greenhouse gas emissions compared to existing industrial processes.

This project and the McLean Plant will play a pivotal role in establishing the foundation for the emergence of commercial-scale manufacturing facilities in North Dakota, aimed at seizing the economic potential presented by the onshoring of advanced carbon product production. Serving as a cornerstone, the production of carbon pitch from lignite coal will unlock additional manufacturing prospects, where lignite-derived carbon pitch serves as the basis for further refinement into high-value carbon materials and products. Over time, this endeavor has the potential to attract substantial capital investment, generate thousands of sustainable jobs, and contribute to the reduction of greenhouse gas emissions within the U.S. manufacturing sector.

The long-term success of this project, therefore, will be measured by the following:

1. *Commercial pitch production facilities*. How many commercial scale pitch production facilities will be located in North Dakota and in what time frame? Our hope, pending successful technical results, would be to enable at least one commercial facility located in North Dakota by 2026 with an installed capacity of 28,500 tons of production annually (including all products and by-products).

2. *Downstream manufacturing facilities*. How many additional advanced carbon products manufacturing facilities will be located in North Dakota that use carbon pitch as a feedstock, and what will be their economic impact? Our hope is that by 2030, there could be a network of manufacturers locating in North Dakota, leading to hundreds of jobs during construction and facility operations.

In order to evaluate the success of the proposed project, specific criteria need to be met:

- **Technical Milestones.** The project aims to achieve several technical milestones crucial for optimizing AmeriCarbon's reactor design and integrating it into the base module. These milestones include conducting a detailed concept design review and analysis of the AmeriCarbon reactor to evaluate process and mechanical constraints, identifying and developing preliminary design specifications for the optimized reactor, conducting engineering analysis and prototype design to establish the initial design basis, fabricating, installing, and commissioning the prototype reactor, and generating lignite-based pitch materials with the prototype reactor to validate its performance and gather feedback from stakeholders.

- **Operational Efficiency.** A key measure of success will be the operational efficiency achieved through the optimized reactor design. This involves maximizing throughput while minimizing energy consumption, waste generation, and overall production costs. The project will strive to achieve a significant improvement in process efficiency, ensuring that the reactor operates reliably and consistently at optimal performance levels.

By meeting these standards of success, the project will not only advance the domestic production of advanced carbon products but also contribute to job creation, economic growth, and environmental sustainability in North Dakota and beyond.

5. Background

Existing AmeriCarbon Facility and Background

The roots of AmeriCarbon's proprietary and patented Liquid Carbon Process date back to 2009, when a predecessor organization built a pilot-scale unit for broad coal liquefaction applications. AmeriCarbon re-engineered the facility to create the Liquid Carbon Process for intentional production of tailored isophase and mesophase coal pitch intermediates and needle cokes. AmeriCarbon has produced pitch from lignite, bituminous and sub-bituminous coals and has also produced needle coke in the facility.

AmeriCarbon has the only known pilot-scale, coal liquefaction-based, pitch production facility in the world. The facility, detailed in the Project Description section, is a 12,000 sq-ft facility that contains infrastructure for laboratory through pilot-scale research and development. This allows for immediate and directly scalable engineering data from applied research generated to be confidently translated to a commercial scale plant. In our discussions with prospective customers, nearly all have expressed concerns about a lack of supply availability and desire to secure a domestic source of economical coal-derived pitch/chemical intermediate.

The Initial NDIC Project: Technical and Economic Feasibility Assessment

From January 2022 through June 2023, AmeriCarbon executed a project titled ***North Dakota Lignite Coal-Based Pitch for Production of High Value Carbon Products via AmeriCarbon Liquid Carbon Pitch (LCP) Process***, which was funded in part by NDIC. At the onset of that project, AmeriCarbon and its collaborators had technical theories and reason to believe that it would be technically feasible to convert North Dakota lignite coal into a coal tar pitch product. Implementation of the project has yielded the following results:

- ✓ Identified and quantified specific market applications
- ✓ Gained an understanding of desired product specifications
- ✓ Conducted chemical formulation and process evaluation studies
- ✓ Produced carbon products from lignite coal that have been tested and confirmed to meet market and customer specifications
- ✓ Evaluated by-products that contribute to the commercial viability of the liquid carbon process
- ✓ Developed a technoeconomic model that meets investor return thresholds

Under the initial project, AmeriCarbon and its project collaborators demonstrated that the production of carbon pitch from North Dakota lignite coal is technically feasible for multiple applications.

Engineering Design of AmeriCarbon LCP Base Module

In October 2022, AmeriCarbon engaged an engineering design contractor to develop an engineering design for the AmeriCarbon LCP process, focused on the production of *Eco-Pitch*™, hydrocarbon by-products, and ash by-product. Under that ongoing effort, which has been funded to date exclusively by AmeriCarbon, preliminary engineering designs have been developed for AmeriCarbon's base module to produce Eco-Pitch™ from coal; the effort includes establishing cost estimates for equipment and other capital expenses required for construction and operation of the base module to produce *Eco-Pitch™* and its referenced by-products. The work product from this effort will achieve one of the key critical requisites for developing a commercial scale facility such as the McLean Plant. AmeriCarbon recently completed its third phase of engineering design (FEL2), which was completed by Worley Parsons.

Engineering Design of Asphalt and Graphite Modules

In 2023, NDIC contributed funding support to a second project with AmeriCarbon, titled ***Engineering Design and Feasibility Analysis for Commercial Graphite and Asphalt Manufacturing from Lignite-Derived Carbon Pitch***, to initiate engineering design and validate economic viability for the asphalt and battery modules of the McLean Plant. This second project builds on the prior effort funded by the NDIC in January 2022, which identified and demonstrated the technical potential of asphalt and battery grade graphite derived from lignite coal utilizing AmeriCarbon's patented/proprietary LCP process. The following are expected project results and deliverables:

- Front End Loading Engineering (FEL 1) to provide opportunity assessment and design basis for a commercial plant in North Dakota;
- Experimental process development studies to provide basis for the engineering design/study, technology readiness and the supply of product samples for customer assessment; and
- Technoeconomic evaluation study to verify business case for commercial plant.

The project currently being proposed builds on the prior work funded in part by NDIC, further improving the technical and economic viability of the conversion of lignite coal to coal tar pitch, thereby accelerating the development and finance of the planned McLean Plant, a commercial scale pitch manufacturing facility planned in North Dakota.

Prior Background

The basis for AmeriCarbon's Liquid Carbon Process was derived from long-standing coal liquefaction technology. Coal liquefaction was first successfully developed and implemented in Germany around the time of World War I because of abundance of coal reserves and the need to find alternative resources to petroleum-based transportation fuel for military vehicles like tanks, airplanes and warships. Friedrich Bergius, a German chemist, was the first to invent direct coal liquefaction to convert lignite to fuel in 1913 [22]. Bergius developed a process that required high pressure (70 MPa) and temperature (> 500^{0}C) using iron-based catalyst. The indirect coal liquefaction process was later developed in 1923, famously known as Fischer-Tropsch process. In this process, the coal is first converted into "synthesis gas" (syngas) which is mainly a mixture of H_2 and CO, which is then converted into light hydrocarbon liquid fuel through a series of steps. Both these methods, direct and indirect coal liquefactions, were developed primarily to covert different types of coal into a fuel source[23, 24]. The third method is pyrolysis in which coal is converted partly into liquid hydrocarbon and remining into gaseous hydrocarbon and coke. This liquid hydrocarbon is commonly known as "coal tar", which served as a starting material for lot of chemical and material development[25, 26]. After Germany, United States and Japan also embarked on all three different ways of coal liquefaction; direct, indirect and pyrolysis simultaneously. Unfortunately, the research exploration in this field started to cease as an enormous supply of petroleum was identified in Middle East in 1950. Currently, the only major liquefaction plants worldwide are operated by Sasol (syngas, indirect liquefaction) in South Africa and by Shenhua (direct liquefaction) in China[27].

Until recently (driven by AmeriCarbon's efforts to adapt the process for pitch production), there has not been a critical demand to pursue coal liquefaction technology in the United States. However, recent efforts both in the United States and globally to exploit the superior properties of advanced carbon materials have prompted AmeriCarbon to leverage prior liquefaction efforts with its own innovations to produce the key intermediate chemical linking carbon-rich coal to manufactured carbon products…coal tar pitch. In the past, the United States had significant coking ovens for steel making that also produced coal tar pitch as a by-product. This was sufficient at the time, but two things have since changed that caused a shortage in U.S. coal-tar pitch supply:

- US-based coke ovens have largely closed due to loss of the US steel industry and environment challenges with the coke ovens;
- Rapid and projected exponential growth of the carbon-based materials industry

AmeriCarbon is on an aggressive path to commercialize this technology and is currently focused on completing research/development and optimizing the process to allow intentional pitch plants to be scaled for specific coals.

Please refer to the Project Summary section for additional background regarding the project and the associated technologies.

6. Qualifications

AmeriCarbon Team Members

AmeriCarbon has assembled a credentialed project team and has developed a portfolio of strategic alliances with innovative developers, research institutions, and industry partners. Its executives bring expertise in the technical subject matter of hydrocarbon conversion, advanced coal products, technology scaleup and commercialization, and business and project finance.

Our team contributes the following to the proposed project:

- Technical Expertise. The AmeriCarbon team is led by **David Berry**, who is serving as principal investigator for the project. Dave has numerous patents and patents pending through more than three decades of institutional research experience with the U.S. Department of Energy and U.S. Department of Defense that are focused on hydrocarbon conversion technologies. Dave has extensive experience from the laboratory through the pilot-scale and has surrounded himself with world class researchers and innovative thinkers which have contributed to AmeriCarbon's unique technology. **Dr. Chetan Tambe** will serve as a senior researcher during the project. Dr. Tambe has a decade of experience in process design and development with a focus on hydrocarbon liquid processing. **Mark Scafella** will serve as senior chemical technician. Mr. Scafella constructed the AmeriCarbon LCP pilot facility and has 10 years operating experience in the facility conducting coal liquefaction to various fuels, chemicals and pitch.

- Scale Up Capability. AmeriCarbon's business executives have spent the majority of their decades-long careers working in the realm between laboratory scale research and industrial development. The skills required to commercialize technology through the pilot demonstration phase are invaluable and contribute to AmeriCarbon's special capabilities in technical innovation and application.
- Commercial Track Record. Implementing innovation at pilot and industrial scale requires experience in large commercial transactions and the ability to manage capital with discipline. These qualities are the hallmark of AmeriCarbon's financial and commercial team members, who have raised and managed several hundred million dollars in the energy and materials sectors. **Greg Henthorn** formally serves as AmeriCarbon's vice president of business development and will continue to lead these activities in addition to providing project management and business operations support for the project. **Chad Green** is the company's CFO and has been involved in several billion dollars in commercial finance, including private equity and public markets.

Worley Parsons Team Members

Art Lucas has built a record of engineering accomplishments within various engineering disciplines, with experience at MATRIC, Marathon Ashland Petroleum, Akzo Nobel, Sunoco Chemicals, and DuPont Chemicals. He has provided engineering support for propylene purification and polymerization, polymer extrusion technology, process debottlenecking, solid handling and material transfer operations. He also has experience in simulating chemical processes with engineering software to develop a complete understanding of system dynamics. Art has been heavily involved in the design and detailed engineering for a biodiesel plant based on novel continuous technology. Art has a BS in Chemical Engineering from West Virginia University Institute of Technology.

Note: Detailed resumes from AmeriCarbon and Worley Parsons are included in Appendix 7-I.

7. Value to North Dakota

The proposed project will contribute to onshoring the supply chain of advanced carbon products – with current feedstock demand being largely met by China – and connect the dots all the way from raw materials (in the form of lignite coal) all the way to a finished product, reducing our nation's reliance on foreign suppliers to fuel growth in this strategic area. This economic activity can leverage North Dakota's rich and abundant supply of lignite by using it as a highly valuable raw material feedstock for value-added manufacturing.

The proposed project plays a necessary and critical role in the development of the McLean Plant. Upon breaking ground, the McLean Plant will have immediate, near term, and long-term impacts with respect to the creation of high wage employment for McLean County, North Dakota and the surrounding region. The facility is projected to create 40 high wage full time jobs when the facility opens, with growth to 70 jobs at full capacity. The created jobs will be manufacturing and engineering jobs with high wages and located in and near economically distressed regions. The company has entered into a Memorandum of Understanding regarding a Project Labor Agreement regarding the McLean Plant. AmeriCarbon is committed to workforce development as a major pillar of the company's activities in North Dakota.

The proposed project will enhance the use of North Dakota lignite coal by providing an alternative commercial use other than electricity. In the event that coal-fired electricity generation remains steady over time, this project could also lead to an opportunity to grow the coal industry and provide funds for increased research, jobs, and economic growth and development.

Products of the McLean Plant can be used to create electric vehicles parts and electrodes as well as to keep up with the growing demand for charging stations around the state. It can also lead to additional asphalt production that could extend beyond the state's borders. The McLean Plant will help to preserve existing coal jobs by ensuring demand for the product in case of an economic downturn in the coal industry. The proposed project will also lead to job growth in the coal sector due to the additional demand for lignite coal to be used for carbon pitch. Demand for advanced carbon products is growing annually and when combined with the AmeriCarbon LCP process, the underlying opportunity is to convert lignite coal into valuable products worth several thousand dollars per ton. Job growth can also come from the resurgence of domestic production of carbon pitch in the United States.

8. Management

From an organization/company point of view, AmeriCarbon will serve as the point organization and will manage the project, including all vendors and personnel who are performers under the project. From an individual perspective, David Berry will be the Principal Investigator and lead the project team.

The project will have a flat organizational structure reporting to a single authority, the Principal Investigator. This is intended to streamline project communication and decision making, facilitating the performance of the tasks and achievement of the objectives described in the proposal, including in the Methodology section in a timely and efficient manner, and in the timeframe outlined in the proposal.

The project team's flat organizational structure will allow for efficient and rapid response to questions and challenges that may arise in the performance of the project. Communication will occur largely via videoconferences and telephonic conferences on regularly scheduled and ad hoc bases throughout the project as needed. The principal investigator has considerable experience in managing teams in different locations, managing project scope, and ensuring technical direction without veering off track. This will provide a disciplined approach to project timelines and budgeting while avoiding scope creep challenges. The principal investigator will be responsive to incoming requests from NDIC and is prepared to schedule videoconferences, telephonic meetings, or in-person meetings as desired.

As noted in the attached resumes, which may be found in Appendix 7-1, the principal investigator has more than three decades of research experience, including the management of cross functional teams with diverse skills and competencies. All members of the team have considerable experience managing and performing in similar teams spanning multiple decades.

Risk Management Plan

AmeriCarbon continually identifies risks and challenges to the project, including financial, technical, performance, schedule, and regulatory compliance. Strategies for mitigating and managing these risks include developing contingency plans, conducting risk assessments, and implementing quality assurance and quality control measures. Regular communication and collaboration with stakeholders and team members is essential to keep everyone informed of progress and address any issues or concerns.

The following risks and contingencies have been identified for consideration with respect to the scope of work of the proposed project:

1. ***Technical Complexity and Uncertainty:***

- Risk: The project involves complex technical processes such as reactor design, engineering analysis, and prototype fabrication, leading to uncertainties in outcomes.
- Mitigation: Conduct thorough research and feasibility studies before initiating each task. Engage subject matter experts and leverage advanced simulation tools to predict potential challenges and optimize design parameters. Implement agile project management methodologies to adapt to changing requirements and mitigate technical risks incrementally.

2. ***Operational Challenges:***

- Risk: Operating pressures, temperatures, and flow requirements may pose challenges in achieving desired process performance and operability.
- Mitigation: Implement rigorous testing protocols during the fabrication and commissioning of the prototype reactor to validate its operational capabilities. Conduct comprehensive training for operators and maintenance personnel to ensure efficient operation and troubleshooting of the reactor. Establish contingency plans to address potential operational disruptions and minimize downtime.

3. ***Materials Selection and Compatibility:***

- Risk: Selection of suitable materials of construction (MOC) for the reactor may pose challenges due to compatibility issues with process conditions and materials handling requirements.
- Mitigation: Engage materials engineers and experts in corrosion science to assess MOC requirements and compatibility with the process environment. Conduct thorough testing and qualification of selected materials to ensure their suitability for long-term use in the reactor. Establish quality control measures to monitor material performance and address any issues proactively.

4. ***Supply Chain and Fabrication Risks:***

- Risk: Delays or disruptions in the supply chain for critical components and materials may impact the fabrication and installation schedule of the prototype reactor.
- Mitigation: Diversify the supply chain and establish alternate sourcing options for critical components to reduce dependency on single suppliers. Maintain open communication channels with suppliers to anticipate potential bottlenecks and address them proactively. Implement project scheduling and tracking tools to monitor progress and identify any deviations from the timeline early on.

5. ***Feedback and Collaboration Challenges:***

- Risk: Limited or inadequate feedback from customers and collaborators could hinder the validation and refinement of the prototype reactor's performance.
- Mitigation: Establish clear communication channels with customers and collaborators to facilitate timely feedback on pitch materials processed with the prototype reactor. Organize regular meetings, workshops, and surveys to gather input and insights from stakeholders. Foster a collaborative and transparent working environment to encourage active participation and engagement in the project.

9. Timetable

The proposed project is anticipated to take 18 months from project initiation. The following is a timeline Gantt chart with milestones, milestone table and suggested deliverables:

#	Task	Perfomer	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
			Months from Project Start																	
1	**Analysis of AmeriCarbon Concept/Prototype Reactor**	**AmeriCarbon/Worley**	■	■	■															
M1.1	Complete concept design review and analysis				▲															
2	**Identify/Develop Reactor Preliminary Design Specifications**	**AmeriCarbon/Worley**			■	■	■	■												
M2.1	Initial Preliminary Design Spec			▲																
M2.2	Final Reactor Design Specification for Prototype Build				▲															
3	**Engineering Analysis and Prototype Design/Drawings**	**AmeriCarbon/Worley**						■	■	■	■									
M3.1	Preliminary drawings complete								▲											
M3.2	Final fabrication drawings for construction issuance.									▲										
4	**Fabricate, Install and Commission Prototype Reactor**	**AmeriCarbon/Worley**									■	■	■	■	■	■				
M4.1	Order materials/equipment									▲										
M4.2	Install reactor													▲						
5	**Generate Lignite-Based Pitch Material with Prototype Reactor**	**AmeriCarbon/Worley**															■	■	■	■
M5.1	Initial Samples																▲			
M5.2	Final Samples for Customer Evaluation																			▲

Figure 8. *Project timetable.*

The following are the deliverables and timeline:

#	Deliverables	Due Date
D1	Quarterly Reports	Per Quarter End
D2	Pitch Samples	Per Request
D3	Final Report Submission	End of contract

Figure 9. *Table of project deliverables.*

10. Budget

The project budget totals $1,488,809, with $743,809 being requested from NDIC, $20,000 in in-kind services provided by NACoal, and $725,000 provided as in-kind services from AmeriCarbon. A detailed budget was prepared using the standard U.S. Department of Energy budgeting model. Key tables from the budget are included in Appendix 11-1. Where the tables reference “Federal Share”, it is intended to indicate the proposed “NDIC Share”.

11. Matching Funds

Support letters for matching funds are included in Appendix 12-1, including a cost share commitment of $20,000 from NACoal and $725,000 from AmeriCarbon, for a total cost share resulting in a combined cost share of $745,000, representing greater than 50% of the overall budget.

12. Tax Liability

The applicant does not have any past due tax liability with the State of North Dakota. An affidavit is attached in Appendix 13-1.

13. Confidential Information

Not applicable.

14. References

1. Markets, R., 2020. China Coal Tar Industry Report 2019-2025. [online] Available at: https://www.globenewswire.com/newsrelease/2019/02/26/1742153/0/en/China-Coal-Tar-Industry-Report-2019-2025> [Accessed 22 November 2020].

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7. Garcia, J.L. Crespo, S.C. Martin, C.E. Snape, S.R. Moinelo, "Development of Mesophase from a Low-Temperature Coal Tar Pitch", Energy & Fuels 2003, 17, 291-301

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19. Yeware, Krunal, Graphite Market by Type (Natural Graphite and Synthetic Graphite) and Application (Lubrication, Refractories, Foundry, Battery Production, and Others): Global Opportunity Analysis and Industry Forecast, 2019–2027 (2020).

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15. Appendices

Attached.

Appendix 6-1

DAVID A. BERRY

EDUCATION AND TRAINING

West Virginia University, Chemical Engineering, B.S. (1984)
West Virginia University, Chemical Engineering, M.S. (1999)

RESEARCH AND PROFESSIONAL EXPERIENCE

CEO/CTO – AmeriCarbon LLC, Morgantown, WV, 2020 – current:
Leading the commercialization of coal conversion to enabling carbon pitch intermediate for high-value carbon product manufacturing such as arc furnace carbon electrodes, advanced battery storage electrodes, carbon fibers, carbon foams, computer chips and other carbon-based products for commercial and defense sector. owns and operates a 12,000 ft2 research/production facility with full laboratory facilities (vented hoods, wet chemistry, etc.) as well a continuous PLC controlled pilot scale hydrocarbon processing train for high temperature/high-pressure chemical conversion and other PLC controlled pilot space.

Associate Director – National Energy Technology Laboratory, Morgantown, WV, 2009 – 2020:
Managed a multi-million-dollar research program of engineers and scientists with primary expertise in catalysis, reaction engineering, surface science, electromagnetic energy, plasma chemistry, hydrocarbon conversion (coal, oil, NG) and materials science. Major focus in the development of fossil energy conversion technologies involving fuels/chemicals production, gas cleanup, power-generation cycles (turbines, fuel cells, hybrids), syngas conversion and hydrocarbon fuel reforming (i.e. diesel, logistic fuels, natural gas, coal-derived, bio-fuel…) including coal/biomass & methane gasification. Responsible for oversight of >36 laboratories ranging from bench-scale to small pilot operations.

Research Leader – National Energy Technology Laboratory, Morgantown, WV, 1992 – 2009:
Managed/conducted research for a $10 Million per year, multi-disciplined research team (engineers, scientists, technicians) in the development of fuel processing technology involving projects ranging in size from $200,000 – $500,000 per year. Focus involved developing capability and technology for processing of hydrocarbon fuels (i.e. diesel, logistic fuels, natural gas, coal-derived, bio-fuel…) for integrated operation with fuel cell systems. Developed program for coal/biomass & methane gasification. Established new science capability development with plasma and electromagnetic frequency technologies. Construction & operations of multiple laboratories from laboratory through small pilot scale. Processes include test reactors (fixed, fluid, and transport), catalyst and sorbent preparation and an array of analytical characterization equipment/methods.

Technology Manager – National Energy Technology Laboratory, Morgantown, WV, 1986 – 1992:
Managed a $10 million per year research and development program for the development of advanced high temperature solid oxide fuel cell power generation systems. Conducted all phases of planning (vision/objectives/requirements), budgeting, patents/license and functional management of multiple development projects with values ranging from $200 k to $150 M. Interfaced with academia, government (civilian & defense), industrial, and utility groups, both foreign and domestic, to accomplish and facilitate the development. Facilitated technology development and demonstration through coordinated cost participation between industrial participants, natural gas utilities and electrical power generation utilities.

Project Manager – Belvoir R&D Center, Fort Belvoir, VA, 1984 – 1986:
Managed and conducted engineering for development effort between various military groups and industrial companies (Allied Signal, Goodyear, OPW…) for a turbine-based helicopter and ground vehicle refueling system for use in extreme arctic conditions from development stage through conduct of end user/military acceptance testing and eventual acceptance into official army inventory.

PUBLICATIONS - Selected

1. Ping Wang, Bret Howard, Nicholas Means, Dushyant Shekhawat, David Berry. “Coal chemical-looping with oxygen uncoupled (CLOU) using a Cu-based oxygen carrier derived from natural minerals”. Energies 2019, 12, 1453, doi:10.3390/en12081453.
2. Daniel J Haynes, Dushyant Shekhawat, David A Berry, Amitava Roy, James J. Spivey, Effect of calcination temperature on the steam reforming activity of Ni substituted pyrochlore catalysts, Jun 2018 to Applied Catalysis: A: Gen.
3. Ping Wang, Nicholas Means, Bret Howard, Dushyant Shekhawat, and David Berry, The Reactivity of CuO Oxygen Carrier and Coal in Chemical-Looping with Oxygen Uncoupled (CLOU) and In-situ Gasification Chemical-Looping Combustion (iG-CLC), Fuel 217 (2018) 642-649).
4. M.W. Smith, D.A. Berry, D. Shekhawat, D.J. Haynes, J.J. Spivey, Partial oxidation of liquid hydrocarbons in the presence of oxygen-conducting supports: Effect of catalyst layer deposition, Fuel, 89 (2010) 1193-1201.
5. D.J. Haynes, A. Campos, M.W. Smith, D.A. Berry, D. Shekhawat, J.J. Spivey, Reducing the deactivation of Ni-metal during the catalytic partial oxidation of a surrogate diesel fuel mixture, Catal Today, 154 (2010) 210-216.
6. D. Shekhawat, D. A. Berry, H. W. Pennline, E. Granite, J. J. Spivey, Special Issue: Advanced Fossil Energy Utilization, Fuel, Volume 89, Issue 6, January 1, 2010.
7. Maria D. Salazar-Villalpando, D. A. Berry and A. Cugini, Role of Lattice Oxygen in the Partial Oxidation of Methane over Rh/Supported Ceria Catalysts. Isotopic Studies, Solid State Ionics, December 2009.
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PATENTS - Selected

1. U.S. Patent # 9,935,318 SOFC Cathode with Oxygen Reducing Layer, (2018)
2. U.S. Patent 9,598,644 Method of CO and/or CO2 hydrogenation to higher hydrocarbons using doped mixed metal oxides, (2017).
3. U. S. Patent 9,562,203 Methane-rich syngas production from hydrocarbon fuels using multi-functional catalyst/capture agent, (2017).
4. U.S. Patent 9,126,833 Process for continuous synthesis of mixed oxide powders, (2015).
5. U.S. Patent 8,486,301 Method for designing a reforming and/or combustion catalysts system, (2013).
6. U.S. Patent # 7,442,353 “Heat Recirculating Reformer for Fluid Stream Pollutant Removal, (2008).

SYNERGISTIC ACTIVITIES

- Editorial Board Member, “Catalysis Today”, January 2006-2009.
- Distinguished Visiting Scientist, Oak Ridge National Laboratory, April 2002.
- Research Management Board Member, Army Core Technology Program (CTP) for Power Systems, June 2005 / 2006.

GREGORY G. HENTHORN

EDUCATION

West Virginia University, Morgantown, WV, Executive MBA (2003);

West Virginia University, Morgantown, WV, J.D. (2000)

West Virginia University, Morgantown, WV, B.S., Chemical Engineering (1995)

RESEARCH AND PROFESSIONAL EXPERIENCE

AmeriCarbon Products, LLC; VP of Corporate Development; Morgantown, WV; 2020-present; Focuses on commercial transactions; investor relations, capital attraction and management; business development with customers and collaborators; administrative and financial oversight.

West Virginia University; Associate Professor (Adjunct); Morgantown, WV; 2019-present; Energy Production and Operations (ENLM 220)

Flat Rock Energy; EVP of Business Development; Morgantown, WV; 2010-2020; Flat Rock is a private equity funded oil and gas exploration and production company that develops, funds, and implements drilling programs in the Appalachian Basin. Founder of company, securing more than $100 million in private equity funding; Negotiated commercial transactions with investors and other oil and gas operators.

Kinetic Clean Energy; Managing Partner; Morgantown, WV; 2007-2010; The company coordinated the origination, development, and finance of several methane-based renewable energy projects. Financed more than $50 million in renewable electric power facility construction projects; Organized facility to convert fleet vehicles to compressed natural gas; Assisted in the formation of a team to commercialize ethane-to-plastics technology.

Fourth Venture Group; Vice President; Morgantown, WV; 2000-2007; Fourth Venture was an angel capital and early stage venture capital firm that served as a launching pad for technology commercialization and economic development. Served as Chief Operating Officer for a 500,000-

member online portal that integrated with hundreds of brick-and-mortar merchants; Worked with DOE laboratories and NGOs to commercialize technologies developed in former Soviet military research institutes; Explored development of a liquefaction facility to convert coal to liquid transportation fuels; Co-founded an enterprise-class business-to-business software company that was focused on the surveying and construction sectors, from establishment of the business to its divestiture; Held executive management positions in two specialized manufacturing companies.

SELECTED PUBLICATIONS & PRESENTATIONS

- "New Business Opportunities in TransTech Energy Technologies", West Virginia Senate Economic Development Committee Meeting, West Virginia State Capitol, January 18, 2011.
- "Opportunities for the Coal Industry to Create Revenue from Carbon Offsets", 36th Annual West Virginia Mining Symposium, West Virginia Coal Association, Civic Center, Charleston, WV, February 18, 2009.
- Bai, Xingji and Henthorn, Greg. "13 Per Day." *Capacity Magazine* Spring (2007): 77-79. Print.

SYNERGISTIC ACTIVITIES

1. **TechConnectWV**, Charleston, WV; Member, Board of Directors, 2004-present; Member, Executive Committee, 2010-present. TechConnectWV is a non-profit, 501(c)(3) organization dedicated to the advancement of science, technology, and the innovation economy in West Virginia.
2. **West Virginia University**, under contract with Kinetic, 2012-2016; *Feasibilities of a Coal-Biomass to Liquids Plant in Southern West Virginia* (Award DE-FE0009997).
3. National Research Center for Coal & Energy, West Virginia University, Morgantown, WV; Consultant, Energy Efficiency Division, under contract with Kinetic, 2010-2011; *Supported establishment of initial TransTech Energy Conference*.
4. **West Virginia High Technology Consortium Foundation**, Fairmont, WV; Consultant, INNOVA Commercialization Group, 2010-2011; *Identification of technology commercialization and investment opportunities at NETL and WVU*

Art Lucas

Senior Principal Process Engineer

Summary

Mr. Lucas has more than twenty-two years of process design and research experience in the Chemical and Polymer industries. Responsibilities have included process engineer, research engineer and other roles.

Education

2000 B.S. Chemical Engineer, West Virginia Institute of Technology, Montgomery, WV

Experience

2023-Present Senior Principal Process Engineer, Worley, Charleston, WV

- Air Permitting & Emissions for Blue Ammonia Technology
- Proposal and Scope Work OSBL Blue Ammonia Technology
- Plastics Recycling Technology
- UniSim Modeling with OLI Software
- Worley Education Passports in Low Carbon Hydrogen, Ambition, Sustainability, Energy

2006-2023 Senior Research Engineer, MATRIC, South Charleston, WV

Technology development and deployment of various technologies at both laboratory and pilot scale as listed below.

- Batch polymerizations with novel technologies
- Liquid-Liquid Extractions
- Membrane technology and filtrations
- High Molecular weight polymerization
- Pyrolysis Technology
- Agitated filter drying and precipitations
- Adsorption Technologies
- Renewable Energy Technology
- Recycle Technology for various consumer products
- Chlorination reactions with shock sensitive byproducts
- Algae processing to make nutraceuticals

- Wiped Film evaporation and azeotropic distillations
- Slurry handling of both miscible and immiscible solutions.
- Solids handling of pseudoplastics and high viscosity polymers

Responsibilities included the following:

- Technical liaison with customers technical staff to develop scope of work, project execution plans and testing protocols.
- Developed all documentation for pilot scale operations. This included but not limited to, P&IDs, mass and energy balances, operating procedures, EHS, Safety assessments, emergency response and daily operational plans.
- Managed customer projects from concept to completing. A Dual role as Senior Research Engineer and Project Manager. Managed average capital expenditures of $500K to as excess of $1.5MM.
- Technical documentation for patent filing for successful technology for both the customer and internal research projects.
- Trained the operation workforce on the new technology deployments. This includes sample methodology as well as operation know how.
- Developed technology packages for renewable energies as part of the Renewable Fuel Standard.
- Worked with customer to mitigate risk for large scale fermentation to acid technology hurdles. Solutions were adopted and customer deployment commercial scale implementation in excess of $300MM.
- Developed and patented technology in Pyrolysis and Reverse Osmosis Membranes.
- Lead engineer for design and implementation of patented continuous biodiesel facility. Overseen technology transfer, prepared design and bid packages and orchestrated project implantation in a cradle to grave role. This also included writing all Standard Operation procedures an defining the safety and compliance issues for the facility.

2006 – 2006 Process Engineer, DuPont Chemical Company, Belle, WV

- Debottlenecking process by redeveloping process conditions.

Solid Handling and Material Transfer

Vacuum Operations

Slurry Transfer

Batch Processing

Blending and Conveying

- Responsible for all activities surrounding production metrics of the unit.
- Provided 24hr coverage for area of unit responsibility to provide direction as require for all production problems.
- Organized a process workflow system that directed the human interfaces with the process for optimal performance.
- Educated/Trained operations on critical paths for success and very instrumental in fostering a higher standard ow work practices of operational employees.
- Developed and implemented new process guidelines and control limits.
- Responsible for operational instructions for evening and night shift employees.

2001 – 2005 Project/Process Engineer, Sunoco Chemical – Kenova, WV

Extrusion Process

- Implemented Rheology technologies for improved process control.
- Project engineer for de-bottlenecking extrusion line.

Capital $1.75 MM

Designed and implemented Master Batch Additive System

- Rotating equipment

Twin Screw Extruders

Gear pumps

Blenders

Conveyors

Rotary valves

Pelletizers

Bulk material transfer

Gravity and pneumatic conveying systems

- Decreased off spec product by improving raw additive blend methods.
- Fully utilized new and existing PLC components for decreasing labor efforts along additive system.
- Orchestrated work efforts with hourly group to obtain new process workflow and procedure for new equipment.
- Preventative maintenance routines and monitoring for new equipment.
- Daily engineering support to production. Organized and developed “Best Practices” along extrusion line using root cause analysis.

300% increase in reliability

Increased first pass prime material from 93% to 98.2%.

Polymerization Process:

- Improved first stage reaction control by installing a refrigerated water/glycol system.
    - Twin screw and reciprocating compressor technology
- Operating Discipline Rollout member
- Spheripol Catalyst Technologies
- Provided engineering support to operations for high activity catalyst trials.
- Combined reaction kinetics and catalyst technologies to minimize byproduct formation.
- Decreased off-spec product by 50% by developing and implementing IMR models for online Rheology measurement.

Propylene Purification:

- Catalyst technologies for feedstock purifications
- Installed and commissioned first Nickel catalyst bed within Chemicals division ($100K capital).

- Utilized regeneration techniques to improve Lead Oxide catalyst bed life.
- Replaced and re-commissioned Lead Oxide beds ($250K capital).
- Replaced and re-commissioned Alumina Oxide/Mole Sieve catalyst beds ($100K capital).
- Installed various pumps and valves to maintain and improve operation.

Facility Wide Accomplishments

- Engineering member for Honeywell DCS Fail Safe Controller Installation
- Flare monitoring and reporting for WV Department of Air Quality
- Site Process Hazard Analysis leader for HAZOP studies
- Design member for new Management of Change procedure for Sunoco Chemicals Ohio Valley Region
- ISO auditor

2000 – 2001 Process Engineer, AKZO Nobel Functional Chemicals, Gallipolis, WV

- Identified and resolved heat load bottlenecks for increased throughput.
- Optimized CSTR's to produce higher yields while minimizing raw material.
- Served as team leader and engineering supervisor during two new product campaigns to market.
- Plant liaison for third party engineering capital project: $150K
- Multiple small capital projects under $50K

1997 – 1999 Chemical Engineer Co-Op, Marathon Ashland Petroleum, Ashland, KY

- Optimization of fired heaters and steam utilities at the refinery
- Reclaimed precious metal catalyst from large reactors.
- Prepared daily reports for energy economics within refining operations.
- Worked with EPA on conditions to obtain environmental compliance.

Appendix 10-1

Instructions and Summary

Award Number:

Award Recipient: AmeriCarbon Products LLC

Date of Submission: 10/1/2021

Form submitted by: AmeriCarbon Products, LLC

(May be award recipient or sub-recipient)

Please read the instructions on each worksheet tab before starting. If you have any questions, please ask your DOE contact!

1. If using this form for award application, negotiation, or budget revision, fill out the blank white cells in workbook tabs a. through j. with total project costs. If using this form for invoice submission, fill out tabs a. through j. with total costs for just the proposed invoice and fill out tab k. per the instructions on that tab.

2. Blue colored cells contain instructions, headers, or summary calculations and should not be modified. Only blank white cells should be populated.

3. Enter detailed support for the project costs identified for each Category line item within each worksheet tab to autopopulate the summary tab.

4. The total budget presented on tabs a. through i. must include both Federal (DOE) and Non-Federal (cost share) portions.

5. All costs incurred by the preparer's sub-recipients, vendors, and Federal Research and Development Centers (FFRDCs), should be entered only in section f. Contractual. All other sections are for the costs of the preparer only.

6. Ensure all entered costs are allowable, allocable, and reasonable in accordance with the administrative requirements prescribed in 2 CFR 200, and the applicable cost principles for each entity type: FAR Part 31 for For-Profit entities; and 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

7. Add rows as needed throughout tabs a. through j. If rows are added, formulas/calculations may need to be adjusted by the preparer. Do not add rows to the Instructions and Summary tab. If your project contains more than three budget periods, consult your DOE contact before adding additional budget period rows or columns.

8. ALL budget period cost categories are rounded to the nearest dollar.

BURDEN DISCLOSURE STATEMENT

Public reporting burden for this collection of information is estimated to average 3 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of Information Resources Management Policy, Plans, and Oversight, AD-241-2 - GTN, Paperwork Reduction Project (1910-5162), U.S. Department of Energy, 1000 Independence Avenue, S.W., Washington, DC 20585; and to the Office of Management and Budget, Paperwork Reduction Project (1910-5162), Washington, DC 20503.

SUMMARY OF BUDGET CATEGORY COSTS PROPOSED

The values in this summary table are from entries made in subsequent tabs, only blank white cells require data entry

Section A - Budget Summary

	Federal	Cost Share	Total Costs	Cost Share %	Proposed Budget Period Dates
Budget Period 1	$743,809	$745,000	$1,488,809	50.04%	
Budget Period 2	$0	$0	$0	0.00%	
Budget Period 3	$0	$0	$0	0.00%	
Total	$743,809	$745,000	$1,488,809	50.04%	

Section B - Budget Categories

CATEGORY	Budget Period 1	Budget Period 2	Budget Period 3	Total Costs	% of Project	**Comments** (as needed)
a. Personnel	$409,200	$0	$0	$409,200	27.49%	
b. Fringe Benefits	$72,948	$0	$0	$72,948	4.90%	
c. Travel	$10,088	$0	$0	$10,088	0.68%	
d. Equipment	$96,779	$0	$0	$96,779	6.50%	
e. Supplies	$17,450	$0	$0	$17,450	1.17%	
f. Contractual						
Sub-recipient	$0	$0	$0	$0	0.00%	
Vendor	$280,000	$0	$0	$280,000	18.81%	
FFRDC	$0	$0	$0	$0	0.00%	
Total Contractual	$280,000	$0	$0	$280,000	18.81%	
g. Construction	$0	$0	$0	$0	0.00%	
h. Other Direct Costs	$0	$0	$0	$0	0.00%	
Total Direct Costs	$886,465	$0	$0	$886,465	59.54%	
i. Indirect Charges	$602,344	$0	$0	$602,344	40.46%	
Total Costs	$1,488,809	$0	$0	$1,488,809	100.00%	

Additional Explanation (as needed):

a. Personnel

INSTRUCTIONS - PLEASE READ!!!

1. List project costs solely for employees of the entity completing this form. All personnel costs for subrecipients and vendors must be included under f. Contractual.

2. All personnel should be identified by position title and not employee name. Enter the amount of time (e.g., hours or % of time) and the base pay rate and the total direct personnel compensation will automatically calculate. Rate basis (e.g., actual salary, labor distribution report, state civil service rates, etc.) must also be identified.

3. If loaded labor rates are utilized, a description of the costs the loaded rate is comprised of must be included in the Additional Explanation section below. DOE must review all components of the loaded labor rate for reasonableness and unallowable costs (e.g. fee or profit).

4. If a position and hours are attributed to multiple employees (e.g. Technician working 4000 hours) the number of employees for that position title must be identified.

5. Each budget period is rounded to the nearest dollar.

SOPO Task #	Position Title	Budget Period 1			Budget Period 2			Budget Period 3			Project Total Hours	Project Total Dollars	Rate Basis
		Time (Hrs)	Pay Rate ($/Hr)	Total Budget Period 1	Time (Hrs)	Pay Rate ($/Hr)	Total Budget Period 2	Time (Hrs)	Pay Rate ($/Hr)	Total Budget Period 3			
1	Sr. Engineer **(EXAMPLE!!!)**	2000	$85.00	$170,000	200	$50.00	$10,000	200	$50.00	$10,000	2400	$190,000	Actual Salary
2	Technicians (2)	4000	$20.00	$80,000	0	$0.00	$0	0	$0.00	$0	4000	$80,000	Actual Salary
1,2,3,4,5	Principal Investigator	875	$175.00	$153,125			$0			$0	875	$153,125	
1,2,3,4,5	Chemical Engr Executive	125	$125.00	$15,625			$0			$0	125	$15,625	
1,2,3,4,5	Chemical Engineer	1395	$60.00	$83,700			$0			$0	1395	$83,700	
1,2,3,4,5	Chemical Technician (2)	2950	$45.00	$132,750			$0			$0	2950	$132,750	
1,2,3,4,5	Project Manager	320	$75.00	$24,000			$0			$0	320	$24,000	
				$0			$0			$0	0	$0	
				$0			$0			$0	0	$0	
				$0			$0			$0	0	$0	
				$0			$0			$0	0	$0	
				$0			$0			$0	0	$0	
				$0			$0			$0	0	$0	
				$0			$0			$0	0	$0	
				$0			$0			$0	0	$0	
				$0			$0			$0	0	$0	
				$0			$0			$0	0	$0	
				$0			$0			$0	0	$0	
				$0			$0			$0	0	$0	
				$0			$0			$0	0	$0	
				$0			$0			$0	0	$0	
				$0			$0			$0	0	$0	
				$0			$0			$0	0	$0	
				$0			$0			$0	0	$0	
	Total Personnel Costs	**5665**		**$409,200**	**0**		**$0**	**0**		**$0**	**0**	**$409,200**	

Additional Explanation (as needed):

b. Fringe Benefits

INSTRUCTIONS - PLEASE READ!!!
1. Fill out the table below by position title. If all employees receive the same fringe benefits, you can show "Total Personnel" in the Labor Type column instead of listing out all position titles.
2. The rates and how they are applied should not be averaged to get one fringe cost percentage. Complex calculations should be described/provided in the Additional Explanation section below.
3. The fringe benefit rates should be applied to all positions, regardless of whether those funds will be supported by Federal Share or Recipient Cost Share.
4. Each budget period is rounded to the nearest dollar.

Labor Type	Budget Period 1			Budget Period 2			Budget Period 3			Total Project
	Personnel Costs	Rate	Total	Personnel Costs	Rate	Total	Personnel Costs	Rate	Total	
EXAMPLE!!! Sr. Engineer	$170,000	20%	$34,000	$10,000	20%	$2,000	$10,000	20%	$2,000	$38,000
Principal Investigator	153,125	12.34%	$18,896	0	12.34%	$0			$0	$18,896
Chemical Engr Executive	15,625	13.61%	$2,127	0	13.61%	$0			$0	
Chemical Engineer	83,700	17.85%	$14,940	0	17.85%	$0			$0	$14,940
Chemical Technician (2)	132,750	25.40%	$33,719	0	25.40%	$0			$0	$33,719
Project Manager	24,000	13.61%	$3,266	0	13.61%	$0			$0	$3,266
Total:	**$409,200**		**$72,948**	**$0**		**$0**	**$0**		**$0**	**$72,948**

A federally approved fringe benefit rate agreement, or a proposed rate supported and agreed upon by DOE for estimating purposes is required at the time of award negotiation if reimbursement for fringe benefits is requested. Please check (X) one of the options below and provide the requested information if not previously submitted.

______ A fringe benefit rate has been negotiated with, or approved by, a federal government agency. A copy of the latest rate agreement is/was included with the project application.*

__X___ There is not a current federally approved rate agreement negotiated and available.**

*Unless the organization has submitted an indirect rate proposal which encompasses the fringe pool of costs, please provide the organization's benefit package and/or a list of the components/elements that comprise the fringe pool and the cost or percentage of each component/element allocated to the labor costs identified in the Budget Justification.

**When this option is checked, the entity preparing this form shall submit an indirect rate proposal in the format provided in the Sample Rate Proposal at http://www1.eere.energy.gov/financing/resources.html, or a format that provides the same level of information and which will support the rates being proposed for use in the performance of the proposed project.

Additional Explanation (as necessary): Please use this box (or an attachment) to list the elements that comprise your fringe benefits and how they are applied to your base (e.g. Personnel) to arrive at your fringe benefit rate.

c. Travel

INSTRUCTIONS - PLEASE READ!!!

1. Identify Foreign and Domestic Travel as separate items. Examples of Purpose of Travel are subrecipient site visits, DOE meetings, project mgmt. meetings, etc. Examples of Basis for Estimating Costs are past trips, travel quotes, GSA rates, etc.

2. All listed travel must be necessary for performance of the Statement of Project Objectives.

3. Federal travel regulations are contained within the applicable cost principles for all entity types. Travel costs should remain consistent with travel costs incurred by an organization during normal business operations as a result of the organizations written travel policy. In absence of a written travel policy, organizations must follow the regulations prescribed by the General Services Administration.

4. Each budget period is rounded to the nearest dollar.

SOPO Task #	Purpose of Travel	Depart From	Destination	No. of Days	No. of Travelers	Lodging per Traveler	Flight per Traveler	Vehicle per Traveler	Per Diem Per Traveler	Cost per Trip	Basis for Estimating Costs
	Domestic Travel	**Budget Period 1**									
1	**EXAMPLE!!!** Visit to PV manufacturer			2	2	$250	$500	$100	$160	$2,020	Current GSA rates
1-5	Project Kickoff	Pittsburgh, PA	North Dakota	4	2	$450	$800	$150	$236	$3,272	
4	Inspections/Drawing Reviews	Morgantown,	Charleston, WV	2	2	$450	NA	$200	$236	$1,772	
4	Inspections/Drawing Reviews	Morgantown,	Charleston, WV	2	2	$450	NA	$200	$236	$1,772	
1-5	Project Review	Pittsburgh, PA	North Dakota	4	2	$450	$800	$150	$236	$3,272	
	International Travel										
										$0	
	Budget Period 1 Total									**$10,088**	
	Domestic Travel	**Budget Period 2**									
										$0	
										$0	
										$0	
	International Travel										
										$0	
	Budget Period 2 Total									**$0**	
	Domestic Travel	**Budget Period 3**									
										$0	
										$0	
	International Travel										
										$0	
	Budget Period 3 Total									**$0**	
	PROJECT TOTAL									**$10,088**	

Additional Explanation (as needed):

d. Equipment

INSTRUCTIONS - PLEASE READ!!!

1. Equipment means tangible personal property (including information technology systems) having a useful life of more than one year and a per-unit acquisition cost which equals or exceeds the lesser of the capitalization level established by the non-Federal entity for financial statement purposes, or $5,000. Please refer to the applicable Federal regulations in 2 CFR 200 for specific equipment definitions and treatment.

2. List all equipment below, providing a basis of cost (e.g. vendor quotes, catalog prices, prior invoices, etc.). Briefly justify items as they apply to the Statement of Project Objectives. If it is existing equipment, provide logical support for the estimated value shown.

3. During award negotiations, provide a vendor quote for all equipment items over $50,000 in price. If the vendor quote is not an exact price match, provide an explanation in the additional explanation section below. If a vendor quote is not practical, such as for a piece of equipment that is purpose-built, first of its kind, or otherwise not available off the shelf, provide a detailed engineering estimate for how the cost estimate was derived.

4. Each budget period is rounded to the nearest dollar.

SOPO Task #	Equipment Item	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
			Budget Period 1			
3,4,5	**EXAMPLE!!!** Thermal shock chamber	2	$70,000	$140,000	Vendor Quote - Attached	Reliability testing of PV modules- Task 4.3
4,5	Lignite coal dryer - nitrogen	1	$15,779	$15,779		
4	Reactor instrumentation (flow, level probe, etc.)	1	$21,000	$21,000		
4	High capacity slurry pumps	2	$12,500	$25,000		
4	Reactor hot oil/heat transfer fluid heating system	1	$35,000	$35,000		
				$0		
				$0		
	Budget Period 1 Total			$96,779		
			Budget Period 2			
				$0		
				$0		
				$0		
				$0		
				$0		
				$0		
	Budget Period 2 Total			$0		
			Budget Period 3			
				$0		
				$0		
				$0		
				$0		
				$0		
				$0		
	Budget Period 3 Total			$0		
	PROJECT TOTAL			**$96,779**		

Additional Explanation (as needed):

e. Supplies

INSTRUCTIONS - PLEASE READ!!!

1. Supplies are generally defined as an item with an acquisition cost of $5,000 or less and a useful life expectancy of less than one year. Supplies are generally consumed during the project performance. Please refer to the applicable Federal regulations in 2 CFR 200 for specific supplies definitions and treatment. A computing device is a supply if the acquisition cost is less than the lesser of the capitalization level established by the non-Federal entity for financial statement purposes or $5,000, regardless of the length of its useful life.

2. List all proposed supplies below, providing a basis of costs (e.g. vendor quotes, catalog prices, prior invoices, etc.). Briefly justify the need for the Supplies as they apply to the Statement of Project Objectives. Note that Supply items must be direct costs to the project at this budget category, and not duplicative of supply costs included in the indirect pool that is the basis of the indirect rate applied for this project.

3. Multiple supply items valued at $5,000 or less used to assemble an equipment item with a value greater than $5,000 with a useful life of more than one year should be included on the equipment tab. If supply items and costs are ambiguous in nature, contact your DOE representative for proper categorization.

4. Add rows as needed. If rows are added, formulas/calculations may need to be adjusted by the preparer.

5. Each budget period is rounded to the nearest dollar.

SOPO Task #	General Category of Supplies	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
Budget Period 1						
4,6	**EXAMPLE!!!** Wireless DAS components	10	$360.00	$3,600	Catalog price	For Alpha prototype - Task 2.4
	Chemicals, solvents and lubricants	1	$3,750.00	$3,750		
	Heat tracing and insulation	1	$6,350.00	$6,350		
	Piping, fittings, seals, gaskets	1	$7,350.00	$7,350		
				$0		
				$0		
				$0		
				$0		
				$0		
				$0		
	Budget Period 1 Total			**$17,450**		
Budget Period 2						
				$0		
				$0		
				$0		
				$0		
				$0		
				$0		
				$0		
				$0		
	Budget Period 2 Total			$0		
Budget Period 3						
				$0		
				$0		
				$0		
				$0		
				$0		
				$0		
				$0		
				$0		
	Budget Period 3 Total			$0		
	PROJECT TOTAL			**$17,450**		

Additional Explanation (as needed):

f. Contractual

INSTRUCTIONS - PLEASE READ!!!

1. The entity completing this form must provide all costs related to subrecipients, vendors, and FFRDC partners in the applicable boxes below.

2. Subrecipients (partners, sub-awardees): Subrecipients shall submit a Budget Justification describing all project costs and calculations when their total proposed budget exceeds either (1) $100,000 or (2) 50% of total award costs. These subrecipient forms may be completed by either the subrecipients themselves or by the preparer of this form. The budget totals on the subrecipient's forms must match the subrecipient entries below. A subrecipient is a legal entity to which a subaward is made, who has performance measured against whether the objectives of the Federal program are met, is responsible for programmatic decision making, must adhere to applicable Federal program compliance requirements, and uses the Federal funds to carry out a program of the organization. All characteristics may not be present and judgment must be used to determine subrecipient vs. vendor status.

3. Vendors (including contractors): List all vendors and contractors supplying commercial supplies or services used to support the project. For each Vendor cost with total project costs of $250,000 or more, a Vendor quote must be provided. A vendor is a legal entity contracted to provide goods and services within normal business operations, provides similar goods or services to many different purchasers, operates in a competitive environment, provides goods or services that are ancillary to the operation of the Federal program, and is not subject to compliance requirements of the Federal program. All characteristics may not be present and judgment must be used to determine subrecipient vs. vendor status.

4. Federal Funded Research and Development Centers (FFRDCs): FFRDCs must submit a signed Field Work Proposal during award application. The award recipient may allow the FFRDC to provide this information directly to DOE, however project costs must also be provided below.

5. Each budget period is rounded to the nearest dollar.

SOPO Task #	Sub-Recipient Name/Organization	Purpose and Basis of Cost	Budget Period 1	Budget Period 2	Budget Period 3	Project Total
2,4	**EXAMPLE!!!** XYZ Corp.	Partner to develop optimal lens for Gen 2 product. Cost estimate based on personnel hours.	$48,000	$32,000	$16,000	**$96,000**
						$0
						$0
						$0
						$0
						$0
						$0
						$0
		Sub-total	$0	$0	$0	$0

SOPO Task #	Vendor Name/Organization	Purpose and Basis of Cost	Budget Period 1	Budget Period 2	Budget Period 3	Project Total
6	**EXAMPLE!!!** ABC Corp.	Vendor for developing robotics to perform lens inspection. Estimate provided by vendor.	$32,900	$86,500		**$119,400**
1,2,3,4	Worley	Engineering support/services for reactor design, installation and	$250,000			**$250,000**
4	Nitro Steel Fabrication	Certified Stainless Steel Reactor Fabrication - Coded vessel	$30,000			**$30,000**
						$0
						$0
						$0
						$0
		Sub-total	$280,000	$0	$0	$280,000

SOPO Task #	FFRDC Name/Organization	Purpose and Basis of Cost	Budget Period 1	Budget Period 2	Budget Period 3	Project Total
						$0
						$0
		Sub-total	$0	$0	$0	$0

	Total Contractual		$280,000	$0	$0	$280,000

Additional Explanation (as needed):

g. Construction

PLEASE READ!!!

1. Construction, for the purpose of budgeting, is defined as all types of work done on a particular building, including erecting, altering, or remodeling. Construction conducted by the award recipient is entered on this page. Any construction work that is performed by a vendor or subrecipient should be entered under f. Contractual.

2. List all proposed construction below, providing a basis of cost such as engineering estimates, prior construction, etc., and briefly justify its need as it applies to the Statement of Project Objectives.

3. Each budget period is rounded to the nearest dollar.

Overall description of construction activities: Example Only!!! - Build wind turbine platform

SOPO Task #	General Description	Cost	Basis of Cost	Justification of need
		Budget Period 1		
3	EXAMPLE ONLY!!! Three days of excavation for platform site	$28,000	Engineering estimate	Site must be prepared for construction of platform.
	Budget Period 1 Total	**$0**		
		Budget Period 2		
	Budget Period 2 Total	$0		
		Budget Period 3		
	Budget Period 3 Total	$0		
	PROJECT TOTAL	**$0**		

Additional Explanation (as needed):

h. Other Direct Costs

INSTRUCTIONS - PLEASE READ!!!

1. Other direct costs are direct cost items required for the project which do not fit clearly into other categories. These direct costs must not be included in the indirect costs (for which the indirect rate is being applied for this project). Examples are: tuition, printing costs, etc. which can be directly charged to the project and are not duplicated in indirect costs (overhead costs).

2. Basis of cost are items such as vendor quotes, prior purchases of similar or like items, published price list, etc.

3. Each budget period is rounded to the nearest dollar.

SOPO Task #	General Description and SOPO Task #	Cost	Basis of Cost	Justification of need
		Budget Period 1		
5	**EXAMPLE!!!** Grad student tuition - tasks 1-3	$16,000	Established UCD costs	Support of graduate students working on project
	Budget Period 1 Total	$0		
		Budget Period 2		
	Budget Period 2 Total	$0		
		Budget Period 3		
	Budget Period 3 Total	$0		
	PROJECT TOTAL	**$0**		

Additional Explanation (as needed):

i. Indirect Costs

INSTRUCTIONS - PLEASE READ!!!

1. Fill out the table below to indicate how your indirect costs are calculated. Use the box below to provide additional explanation regarding your indirect rate calculation.

2. The rates and how they are applied should not be averaged to get one indirect cost percentage. Complex calculations or rates that do not do not correspond to the below categories should be described/provided in the Additional Explanation section below. If questions exist, consult with your DOE contact before filling out this section.

3. The indirect rate should be applied to both the Federal Share and Recipient Cost Share. **4.**

NOTE: A Recipient who elects to employ the 10% de minimis Indirect Cost rate **cannot claim resulting costs as a Cost Share contribution, nor can the Recipient claim "unrecovered indirect costs" as a Cost Share contribution.** Neither of these costs can be reflected as actual indirect cost rates realized by the organization, and therefore are not verifiable in the Recipient records as required by Federal Regulation (§200.306(b)(1)).

5. Each budget period is rounded to the nearest dollar.

	Budget Period 1	Budget Period 2	Budget Period 3	Total	Explanation of BASE
Provide ONLY Applicable Rates:					
Overhead Rate	50.89%				**Direct Wages**
General & Administrative (G&A)	31.54%				**Total Program Costs**
FCCM Rate, if applicable					
OTHER Indirect Rate					
Indirect Costs (As Applicable):					
Overhead Costs	$245,365			**$245,365**	
G&A Costs	$356,979			**$356,979**	
FCCM Costs, if applicable				**$0**	
OTHER Indirect Costs				**$0**	
Total indirect costs requested:	**$602,344**	**$0**	**$0**	**$602,344**	

A federally approved indirect rate agreement, or rate proposed (supported and agreed upon by DOE for estimating purposes) is required if reimbursement of indirect costs is requested. Please check (X) one of the options below and provide the requested information if it has not already been provided as requested, or has changed.

______ An indirect rate has been approved or negotiated with a federal government agency. A copy of the latest rate agreement is included with this application, and will be provided electronically to the Contracting Officer for this project.

__X___ There is not a current, federally approved rate agreement negotiated and available*.

***When this option is checked, the entity preparing this form shall submit an indirect rate proposal in the format provided by your DOE contact, or a format that provides the same level of information and which will support the rates being proposed for use in performance of the proposed project. Additionally, any non-Federal entity that has never received a negotiated indirect cost rate, except for those non-Federal entities described in Appendix VII to Part 200—States and Local Government and Indian Tribe Indirect Cost Proposals, paragraph D.1.b, may elect to charge a de minimis rate of 10% of modified total direct costs (MTDC) which may be used indefinitely.As described in §200.403 Factors affecting allowability of costs, costs must be consistently charged as either indirect or direct costs, but may not be double charged or inconsistently charged as both. If chosen, this methodology once elected must be used consistently for all Federal awards until such time as a non-Federal entity chooses to negotiate for a rate, which the non-Federal entity may apply to do at any time.**

You must provide an explanation (below or in a separate attachment) and show how your indirect cost rate was applied to this budget in order to come up with the indirect costs show

Additional Explanation (as needed): *IMPORTANT: Please use this box (or an attachment) to further explain how your total indirect costs were calculated. If the total indirect costs are a cumulative amount of more than one calculation or rate application, the explanation and calculations should identify all rates used, along with the base they were applied to (and how the base was derived), and a total for each (along with grand total).

Cost Share

PLEASE READ!!!

1. A detailed presentation of the cash or cash value of all cost share proposed must be provided in the table below. All items in the chart below must be identified within the applicable cost category tabs a. through i. in addition to the detailed presentation of the cash or cash value of all cost share proposed provided in the table below. Identify the source organization & amount of each cost share item proposed in the award.

2. Cash Cost Share - encompasses all contributions to the project made by the recipient, subrecipient, or third party (an entity that does not have a role in performing the scope of work) for costs incurred and paid for during the project. This includes when an organization pays for personnel, supplies, equipment, etc. for their own company with organizational resources. If the item or service is reimbursed for, it is cash cost share. All cost share items must be necessary to the performance of the project. Any partial donation of goods or services is considered a discount and is not allowable.

3. In Kind Cost Share - encompasses all contributions to the project made by the recipient, subrecipient, or third party (an entity that does not have a role in performing the scope of work) where a value of the contribution can be readily determined, verified and justified but where no actual cash is transacted in securing the good or service comprising the contribution. In Kind cost share items include volunteer personnel hours, the donation of space or use of equipment, etc. The cash value and calculations thereof for all In Kind cost share items must be justified and explained in the Cost Share Item section below. All cost share items must be necessary to the performance of the project. If questions exist, consult your DOE contact before filling out In Kind cost share in this section. Vendors may not provide cost share. Any partial donation of goods or services is considered a discount and is not allowable.

4. Funds from other Federal sources MAY NOT be counted as cost share. This prohibition includes FFRDC sub-recipients. Non-Federal sources include any source not originally derived from Federal funds. Cost sharing commitment letters from subrecipients and third parties must be provided with the original application.

5. Fee or profit, including foregone fee or profit, **are not allowable** as project costs (including cost share) under any resulting award. The project may only incur those costs that are allowable and allocable to the project (including cost share) as determined in accordance with the applicable cost principles prescribed in FAR Part 31 for For-Profit entities and 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

6. NOTE: A Recipient who elects to employ the 10% de minimis Indirect Cost rate **cannot claim the resulting indirect costs as a Cost Share contribution.**

7. **NOTE:** A Recipient **cannot claim "unrecovered indirect costs"** as a Cost Share contribution, **without prior approval.**

8. Each budget period is rounded to the nearest dollar.

Organization/Source	Type (Cash or In Kind)	Cost Share Item	Budget Period 1	Budget Period 2	Budget Period 3	Total Project Cost Share
ABC Company **EXAMPLE!!!**	Cash	Project partner ABC Company will provide 20 PV modules for product development at the price of $680 per module	$13,600			**$13,600**
AmeriCarbon	In Kind		$725,000			**$725,000**
NACoal	In Kind		$20,000			**$20,000**
						$0
						$0
						$0
						$0
						$0
						$0
		Totals	**$745,000**	**$0**	**$0**	**$745,000**

Total Project Cost: $1,488,809 **Cost Share Percent of Award: 50.04%**

Additional Explanation (as needed):

Appendix 11-1

North American COAL

March 29, 2024

AmeriCarbon Products, LLC
Attention: Mr. David A. Berry, CEO
3001 Cityview Drive
Morgantown, WV 26501

Subject: Matching Funds Commitment Letter

The North American Coal Corporation (NACoal), a NACCO Natural Resources company, is pleased to support your application for the AmeriCarbon Products, LLC ("AmeriCarbon") in its proposal to the Lignite Energy Council with respect to the North Dakota Industrial Commission (NDIC) research grant program under the title *Lignite Conversion Reactor Optimization for Commercial Carbon Pitch Manufacturing*. The conversion of coal resources into beneficial value-added products is an important area of interest for NACoal.

NACoal is the largest lignite producer in the United States and one of the top 10 coal producers in the United States. We mine and market coal for use in power generation, SNG production, activated carbon production, as well as, providing selected value-added mining services for other natural resources companies. Our corporate headquarters are in Plano, Texas, near Dallas, and we operate surface coal mines in North Dakota, Mississippi, Texas, and Louisiana

We support the NDIC's and AmeriCarbon's efforts of developing lignite coal as a feedstock for the manufacture of critical materials and advanced carbon products. Successful implementation of a strategic approach to developing this critical supply chain opportunity can lead to significant job creation and economic development in North Dakota.

If the grant is awarded to your project, NACoal will be pleased to provide up to $20,000 in in-kind support in the form of coal samples and time for the project that can be used as cost share. We look forward to working with the you on this exciting opportunity. If you have questions or require additional information, please do not hesitate to contact me at the letterhead address or Gerard Goven at 701-250-2604.

Very truly yours,
THE NORTH AMERICAN COAL CORPORATION

George Lovland

George Lovland, P.E.
Engineering Manager

Worley Group, Inc.
2910 Valley Forge St
Bismarck, ND 58503

28 March 2024

David A Berry, CEO
AmeriCarbon Products LLC.
3001 Cityview Drive
Morgantown, WV 26501

Subject: Letter of Support for the North Dakota Industrial Commission (NDIC) research grant program under the title *Lignite Conversion Reactor Optimization for Commercial Carbon Pitch Manufacturing*

Worley is pleased to express interest in supporting the efforts of AmeriCarbon Products, LLC in commercial engineering design & scaleup for its proprietary coal to pitch (EcoPitchTM) technology.

With an office in Bismarck, North Dakota, Worley is a global engineering, procurement, and construction company that provides innovative solutions in the energy, chemicals, resources, and infrastructure sectors. With a comprehensive range of services, our firm is known for our expertise in designing, managing, and implementing complex projects across the globe. Our firm is committed to sustainable practices and focuses on delivering projects that contribute to the development of a more sustainable and resilient future. Worley collaborates with clients to address challenges in areas such as oil and gas, mining, power generation, and environmental management.

Worley will provide engineering services to AmeriCarbon to help support the proposed project. Engineering services will include design, installation, and operational support throughout all phases of the reactor optimization project. Worley will offer this supporting service to AmeriCarbon at a budgeted value of $250K commensurate with the agreed upon project deliverables scope and projected timeline.

Worley is proud to support AmeriCarbon's cutting-edge research and development project to help accelerate the development of commercial scale production in North Dakota. Leveraging our extensive experience in the energy and resources sectors, Worley brings a wealth of knowledge and innovative engineering solutions to propel the project forward, contributing to the advancement of environmentally conscious technologies and resource utilization.

Respectfully,

DocuSigned by:
Richard Clay
839CE3643883468...

Richard Clay
Director of Operations, US East (Charleston WV Office)

cc: Scott Midle | Kevin Legg | Pete Cowger |

AmeriCarbon

April 1, 2024

State of North Dakota
The Industrial Commission
State Capitol
Bismarck, ND 58505
ATTN: Lignite Research Program

RE: Matching Funds Commitment Letter

This is to confirm that the applicant, AmeriCarbon Products, LLC, is committed to providing $725,000 in in-kind services, including personnel time, indirect, and overhead expenses, with respect to the project proposed with the title *Lignite Conversion Reactor Optimization for Commercial Carbon Pitch Manufacturing.* To the extent there are any shortfalls from the cost share to be provided by The North American Coal Corporation, AmeriCarbon will provide additional cost share to address such shortfalls up to a total of $745,000.

We look forward to working with the North Dakota Industrial Commission and the Lignite Energy Council to discuss the enclosed proposal. If you have any questions, I may be reached at (304) 685-6017 or greg.henthorn@americarbon.com.

Sincerely,

Greg Henthorn
Vice President of Corporate Development
AmeriCarbon Products, LLC

Appendix 13-I

AFFIDAVIT

In reference to Section 43-03-04-01, North Dakota Century Code, the undersigned, Gregory Henthorn, Vice President, Corporate Development of AmeriCarbon Products, LLC, a West Virginia limited liability company with a tax mailing address of 3001 Cityview Drive, Morgantown, West Virginia, 26501, being first duly sworn according to law, deposes and states as follows:

1. I am at least 18 years of age.

2. I have personal knowledge regarding the facts as set forth herein.

3. I am the Vice President, Corporate Development of AmeriCarbon Products, LLC, a West Virginia limited liability company ("**AmeriCarbon**").

4. AmeriCarbon does not have an outstanding tax liability owed to the State of North Dakota or any of its political subdivisions.

5. I declare under penalty of perjury under the law of North Dakota that the foregoing is true and correct.

Further Affiant sayeth naught.

Executed and acknowledged by:

Gregory Henthorn

[Continued on the following page.]

JURAT

STATE OF WEST VIRGINIA :

:

COUNTY OF MONONGALIA :

The foregoing instrument was subscribed to and sworn before me this 1st day of April, 2024, by Gregory Henthorn.

[Notarial Seal]

OFFICIAL SEAL
NOTARY PUBLIC
STATE OF WEST VIRGINIA
Roger D Wilkins
UPS Store 1421
364 Patteson Drive
Morgantown, WV 26508
My Commission Expires February 7, 2029

Notary Public

My Commission Expires: 02/07/2029

This instrument was prepared by:
AmeriCarbon Products, LLC, 3001 Cityview Drive, Morgantown, West Virginia, 26501