



CARBON FIBRE GRAND CHALLENGE

Carbon Fibre Grand Challenge Phase III

May 23, 2023

Open to Applications from May 15, 2023, to June 26, 2023.

*Program Guide updated on May 23, 2023, to include that Applicants will need to provide a presentation to the application review committee during the week of August 21 – 25, 2023. Exact presentation dates and times will be confirmed after the application period closes on June 26, 2023.

About Alberta Innovates

Innovation is the catalyst for sustainable jobs, economic and community strength, improved health and environmental benefits. [Alberta Innovates](#) leads and accelerates innovation from discovery to use across all sectors in all parts of the province. As Alberta's largest research and innovation agency, we are uniquely positioned to propel great ideas forward to improve the lives of Albertans today and for generations to come.

Alberta Innovates (AI) believes the research and innovation (R&I) ecosystem is stronger and more sustainable when it is broadly representative of the overall diversity of our community. We strive to

ensure that all interested and qualified parties have an equitable opportunity to participate and contribute to the ecosystem and that our processes are inclusive.

The projects that our programs invest in are critical to how Alberta Innovates achieves positive impact for Albertans in alignment with the Government of Alberta's R&I priorities, as expressed in our corporate Business Plan. (See the most recent Business Plan on our [Publications](#) page on our website.) Accordingly, it is essential for project outcomes to align with those of the program.

The Carbon Fibre Grand Challenge – Phase III is managed through the Clean Resources business unit within Alberta Innovates. Clean Resources helps technology developers and industry clients accelerate technology development and deployment, grow their businesses, and enhance the competitiveness of the resource sector. We provide scientific and technical insights to the Government of Alberta (GOA) on energy and natural resource development, agriculture, economic diversification, emission reduction, and water/land policies. Clean Resources has five innovation portfolios:

- **Advanced Hydrocarbons** supports economic, environmental, and diversification opportunities in Alberta's oil & gas sector.
- **Clean Technology** supports diversification of Alberta's economy through the development of clean technology.
- **Environmental Innovation** supports economic development, environmental performance and healthy communities through investments in knowledge and technology gaps in two major programs: Water Innovation Program and Land and Biodiversity.
- **Agri-Food Innovation** invests in research and innovation supporting data driven decision making and automation for growth of Alberta's agriculture and food sector.
- **Bioindustrial Materials** supports economic development and diversification by investing in greener products and processes using Alberta biomass.

Together, our efforts are to sustain and grow Alberta's oil & gas, agriculture, forestry, and clean technology industries, add value to enhanced and new energy products, reduce greenhouse gas emissions, and protect Alberta's water and land resources.

Program Overview

The Carbon Fibre Grand Challenge ('CFGC') is a \$26 million three-phase competition with the objective of accelerating the development of large-scale production pathways for short and continuous carbon fibre from bitumen-derived feedstocks and promoting their use in manufactured products.

The CFGC is part of an initiative by Alberta Innovates to further the development of non-combustion products and their production technologies, derived from bitumen contained in Alberta's oil sands. The latter are amongst the world's largest hydrocarbon resources, with proven reserves of approximately 170 billion barrels and current production of 3 million barrels per day. At present, most bitumen products are destined for energy generation by combustion (such as gasoline, diesel, and heating oil).

The term "bitumen" is used throughout this web page and in Carbon Fibre Grand Challenge documentation. **No exceptions will be made to this definition.** There are other definitions for bitumen around the world but those definitions do not apply for the purposes of the Carbon Fibre Grand Challenge. Also note that all dollars in the document are Canadian unless otherwise stated.

Bitumen Beyond Combustion ('BBC') is intended to:

- diversify the uses of oil sands bitumen, resulting in high-value, large-scale non-combustion products that can be marketed globally, thereby creating a value-add industry built on Alberta's resource;
- reduce greenhouse gas emissions associated with bitumen from production to consumption;
- contribute to global greenhouse gas emissions reduction by creating low-carbon intensity, light weight BBC products to displace high-carbon intensity metal and glass products used in various industrial sectors including transportation and infrastructure.

Bitumen Beyond Combustion focuses on large-scale non-combustion products and their production technologies that are:

- technically and commercially viable now or can become so;
- competitive with or superior to existing products and production technologies;
- Scalable with potential for at least 100,000 barrels of bitumen per day (bpd) by 2030;
- contributing to Alberta's prosperous, environmentally and socially sustainable diversified economy;

Carbon Fibre ('CF') is one of the identified products that could be made from bitumen. The high strength and stiffness of CF, coupled with low density and high corrosion resistance, along with desirable functional properties (e.g. thermal or electrical conductivity) make composite materials that incorporate CF functionally superior to many conventional metals, wood products, and commercial polymers for use in vehicles, transportation, infrastructure, construction, and consumer products sectors. Alberta

Innovates is working with CF manufacturers and end users, who have been providing market information and target performance specifications. Current demand for carbon fibre is constrained by the high costs of feedstocks and production technologies (primarily based on polyacrylonitrile or pitch) and incorporating fibre into mass produced end-products, like automobile components.

The Carbon Fibre Grand Challenge Phase III program is directed towards funding the development of technologies that can convert feedstocks derived from Alberta's oil sands into CF and the testing of bitumen derived carbon fibre in end use products. Bitumen derived feedstocks should be produced, or have the potential to be produced, in large enough quantities to supply a large-scale carbon fibre industry. These feedstocks may include, but are not limited to, asphaltenes¹ and refinery derived feedstocks. The price of asphaltenes or refinery derived feedstocks from Alberta bitumen are projected to be significantly lower than polyacrylonitrile (\$2 – 5 USD / lb) feedstocks.

Carbon fibre from bitumen-derived asphaltenes is estimated to have significantly smaller environmental impacts than CF produced from other sources, including agriculture and forestry. Oil sands operators, CF producers, and end users have expressed significant interest in carbon fibre derived from bitumen provided performance and cost criteria can also be met.

The objectives of the Carbon Fibre Grand Challenge Phase III are to:

- In a repeatable manner, manufacture carbon fibre from Alberta bitumen derived feeds with consistent performance properties aligned to market needs
- Incorporate carbon fibre manufactured in Phase III into prototypes of end use products and evaluate/validate the performance of the prototypes.
- Understand in great detail the environmental impacts of the manufacturing process and the techno-economics associated with the designed process.

The key outcomes (i.e., measurable effects) the program will accomplish for the benefit of Albertans are:

- Acceleration of bitumen derived carbon fibre production technology towards commercialization
- Development of a roster of products that can incorporate bitumen derived carbon fibre
- Sharing and mobilization of knowledge related to production and use of carbon fibre derived from bitumen
- Development of highly qualified personnel (HQP)
- Future capital investment planned for bitumen derived carbon fibre based on Phase III results
- Future carbon fibre field pilots and commercialization planned
- Creation of spin-off companies

¹ Asphaltenes are defined as the fraction of the bitumen that is soluble in toluene and insoluble in n-alkane solvents. Because they are defined by solubility, there is no single molecule, chemical composition or structure that defines an “asphaltene”. More information on AOA can be found in Appendix B.

Funding

The Carbon Fibre Grand Challenge Phase III has up to \$20,000,000 of funding available to approved projects through this call.

- A successful project can receive up to a maximum of \$4,000,000. In cases where additional government funding is provided, Alberta Innovates reserves the right to reduce its funding so that the maximum funding does not exceed \$4,000,000.
- The Program supports up to 75% of the total project costs, with remaining funding from the Applicant and/or other project partners. Cash is preferred and in-kind is also accepted.
- There is no limit on the amount of stacking towards the Applicant's contribution.
- Funding will be dispersed directly to successful Applicants at the end of each project milestone, based on proof of milestone completion.
- Successful applicants will sign an Investment Agreement with Alberta Innovates.

Alberta Innovates only funds reasonable costs incurred after an Agreement is signed by Alberta Innovates and the Applicant. Any costs incurred prior to the signing of an Agreement, and costs greater than market prices, are ineligible. Costs must be incurred between arm's-length entities. Please refer to Appendix A in this document or the Investment Agreement posted on the Carbon Fibre Grand Challenge Phase III web page <https://albertainnovates.ca/programs/carbon-fibre-grand-challenge/> for eligible and ineligible expenses.

Co-Funding

To maximize available funding for the Carbon Fibre Grand Challenge Phase III Alberta Innovates is working with a trusted funding partner, Emissions Reduction Alberta through their Partnership Intake Program. In some cases, there may be an opportunity to share CFGC Phase III proposals with Emissions Reduction Alberta for consideration of co-funding. Funding from Emissions Reduction Alberta is subject to Emission Reduction Alberta's processes and requirements. Applicants will be asked in their application if Alberta Innovates can share their proposal with Emissions Reduction Alberta to evaluate a potential co-funding opportunity.

If an Applicants permits Alberta Innovates to share their application, after application submission, applications will be reviewed to determine if an opportunity for co-funding consideration exists. If an opportunity is identified for co-funding consideration, additional information may be provided to Applicants by Emissions Reduction Alberta at that time. In such cases, we will strive to reduce administrative burden.

Key Dates

Action	By Whom	Timing
Program Launch	Alberta Innovates	March 15, 2023
Applications Open in Portal	Alberta Innovates	May 15, 2023
Applications Due in Portal	Applicants	June 26, 2023, at 2:00 PM MDT
Funding Decision Notification	Alberta Innovates	September 2023
Earliest Project Start Date	Applicants	October 1, 2023

Eligibility

This program is open to all categories of lead applicant, providing they are legally able to execute the Investment Agreement.

Participation in the Carbon Fiber Grand Challenge Phase III is not dependent on having applied to or been awarded funding in any previous Phase.

Projects can originate from anywhere globally, but Applicants must demonstrate that benefits will accrue to Alberta.

Collaboration between multiple organizations with complementary expertise across the carbon fibre value chain is strongly encouraged. Collaboration can often represent a strong value proposition by demonstrating opportunities for leveraging knowledge, technology validation, and sharing of results.

The maximum project length for projects funded under this Call is **three (3) years** from project commencement. Projects could commence as early as October 2023 and must be completed by September 2026.

Projects or portions thereof that have received Alberta Innovates funding are not eligible to receive further Alberta Innovates funding for the same development. However, applicants may request support for a new phase of development that builds on and sufficiently advances a previously funded project.

Applicant Eligibility

The Carbon Fibre Grand Challenge Phase III is open to technology developers, industry (including small, medium and large size enterprises), industry associations, research and development (R&D) organizations, post-secondary institutions, not-for-profit organizations, and government research labs.

Applicants are not required to be based in Alberta but must demonstrate a clear value proposition for Alberta.

Applicant teams must meet the following requirements:

- Team qualification requirements:
 - a) Demonstrated ability to modify bitumen-based feeds
 - b) Demonstrated ability to prepare carbon fibre (> 10 grams per day)
 - c) Demonstrated ability to evaluate carbon fibre end use application
- General Requirements
 - a) Canadian IP ownership or guaranteed ability to license to Canadian entities
 - b) Spinoff companies are not required
 - c) Teams must supply at least 25% of all funding (cash/in-kind).
- Proposal Requirements
 - a) Have a proposed carbon fibre manufacturing process.
 - b) Preliminary energy requirements for the manufacturing process.
 - c) Potential end uses identified.

Applicants will address the above requirements in their application.

In addition, to qualify for funding, the Applicant must:

- Exist as a corporate person, with up-to-date corporate filings;
- Be authorized to undertake the proposed project, and execute a grant with Alberta Innovates on our standard terms; and
- Not otherwise be prohibited from receiving Alberta Innovates funding, for instance due to a past bad debt or otherwise not be in good financial standing with Alberta Innovates or its subsidiaries, InnoTech Alberta and C-FER Technologies.

Please note: For Applicants that are **not** post-secondary institutions, Alberta Innovates may perform corporate, bankruptcy and litigation searches, and conduct other forms of due diligence on the Applicant company and its principals.

For International Applicants

Carbon Fibre may be a controlled material governed by the Applicant country's national export control laws. Should the Applicant be awarded funding in the Carbon Fibre Grand Challenge – Phase III, as part of Alberta Innovates' reporting requirements, the Applicant will be required to report, in a confidential manner, technical details regarding the testing methods and manufacturing processes related to the carbon fibre developed in the Applicant's project. The Applicant may also be asked to provide a sample of the carbon fibre manufactured in the project to Alberta Innovates. Applicants should ensure that they are familiar with their national export control regulations related to carbon fibre materials and are able to comply with Alberta Innovates' reporting obligations in the event that success in the Phase III project triggers export control regulations and associated licensing requirements within their jurisdiction. Export control regulations and/or failure to obtain an export clearance (to the extent required) do not absolve the Applicant from the responsibility of reporting on technical details in a confidential manner and providing a sample to Alberta Innovates (and the Alberta Government who is Alberta Innovates' sole shareholder). If an Applicant is unable to ensure that the reporting obligations can be fulfilled under their national export control regulations, then an application should not be submitted to the Carbon Fibre Grand Challenge – Phase III.

Project Eligibility

To qualify for funding, all Projects must:

- Align with the objectives of the Carbon Fibre Grand Challenge Phase III;
- Be structured with well-defined project objectives, milestones, deliverables, and timelines to meet the following Phase III outcomes:
 - i. Continuous & repeatable carbon fibre manufacture of >1 kg per week with consistent performance properties over a period of time that allows for the understanding of the environmental impacts and waste streams associated with the manufacturing process.
 - ii. A minimum tensile strength >1,720 MPa and modulus >172 GPa or other strength/modulus combination that meets commercial needs and can be demonstrated through end user performance requirements.
 - iii. Building small-scale prototypes of end products (e.g. test parts) that include bitumen derived carbon fibre.
 - iv. Estimate of lifecycle greenhouse gas emissions and other socio/environmental impacts of the carbon fibre and their products;
 - v. Projected commercial cost of carbon fibre <US\$9 per kg or a demonstrated carbon fibre cost-performance relationship that is at least 50% less expensive than incumbent competitors.
 - vi. Line-of-sight to scale the carbon fibre manufacturing process to >2000 tonnes per year.
 - vii. Demonstrated market potential of products incorporating carbon fibre, utilizing >10,000 tonnes per year of bitumen derived feed use by 2030.
 - viii. Potential of mass manufacture of identified end use products(s) in (iii), concepts for their re-use and end-of-life disposition.

- Be completed by September 30, 2026.
- Include as a work task, at the end of the project, the preparation of a commercialization plan or technology transfer plan that outlines how the technology developed in Phase III will be commercialized for the benefit of Alberta.
- **Any project that does not involve the production of carbon fibre from an Alberta bitumen derived feed will be immediately disqualified and not reviewed.**
- **Costs associated with building a carbon fibre spinning line larger than laboratory bench scale are not eligible.** Alberta Innovates is working with its partners to build a publicly accessible continuous spinning line in Alberta that can be used by successful Phase III applicants during Years 2 and 3 of the program. The spinning line will allow successful applicants to manufacture between 10 grams to 1 kilogram per day of carbon fibre. If greater than 1 kg per day of carbon fibre manufacture is needed, please inquire with Paolo Bomben (paolo.bomben@albertainnovates.ca) for further information of alternative spinning facilities capable of producing this quantity.
- Applicants are required to provide at least 25% of total project funding. Applicant funding may be in the form of cash or in-kind. Cash is preferred and in-kind is also accepted.

Project Expenses

A list of eligible and ineligible expenses for projects in the Carbon Fibre Grand Challenge Phase III Program can be found in Appendix C of the Investment Agreement.

Feedstock Samples

Feedstock(s) used in Projects funded by the Carbon Fibre Grand Challenge Phase III must be derived from Alberta oilsands bitumen. **No exceptions will be made.** Applicants may elect to source feedstock(s) on their own or through the Carbon Fibre Grand Challenge Phase III program. Applicants are asked to indicate on the application form if they will require samples from the Phase III program. Applicants that do not source feedstock from the program are required to demonstrate the Alberta origin of the feedstock and may be required to provide a full characterization for the sample.

For applicants that elect to source samples from the program, different sample types are available. Specification/property sheets for the available samples will be posted on the Carbon Fibre Grand Challenge Phase III website under the Program Resources heading by May 15, 2023. All samples offered through the program as part of Phase III of the Carbon Fibre Grand Challenge have the potential to form carbon fibre, although the processing steps prior to carbon fibre manufacture may differ from sample to sample. All the samples will require some form of processing prior to being suitable for carbon fibre manufacture. Applicants should review the sample specification sheets and carefully consider the information provided (e.g. analytical details, commercial availability) when selecting samples and designing their work plan, scope, and outcomes.

Applicants will be asked in the application which sample(s) they choose to work with. During the contracting Phase, successful Applicants will be connected with the supplier of the sample they chose. The Carbon Fibre Grand Challenge program can provide up to 175 kg for the entirety of Phase III at no cost to the Applicant. If additional sample is required Applicants will need to directly obtain it from a feedstock supplier. If an Applicant requires more sample, please contact Paolo Bomben (paolo.bomben@albertainnovates.ca) to discuss further.

How to Apply

The Program will accept applications between May 15, 2023, and 2 pm MDT on June 26, 2023. The application process is a single stage Full Proposal.



PHASE 1 Registration

- 1) If you have not previously done so, **register** on the [Alberta Innovates Application Portal](#) ("Portal").
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PHASE 2 Full Proposal

- 1) **Access, complete and submit** the Full Proposal (FP) Application Form within the *Funding Opportunities* tab on the Portal dashboard. Applications open **Monday May 15, 2023**, and the deadline for submission of FPs is **Monday, June 26, 2023, at 2:00 PM Mountain Daylight Time**. Late, partial, or incomplete submissions will **NOT** be accepted. Applicants are encouraged to complete their submissions well in advance of the deadline.
 - 2) The review process is highly competitive and only the highest-quality projects will be considered for funding.
 - 3) If the review is positive, a funding recommendation will be made to senior management and may include adjustments to the funding request and / or funding conditions.
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PHASE 3 Agreement & Project Management

Successful applicants will execute an agreement with Alberta Innovates to proceed with the Project. Agreement will include details regarding:

- Reporting on progress to milestones and budget on an agreed timeline during the term of the Agreement; and
- Reporting on progress to outcomes on an agreed to timeline during and following the term of the Agreement.
- Project payments are based on milestone achievement and progress reporting.

Alberta Innovates will provide on-going management, receiving and evaluating Applicants' reporting of milestones and payments on each milestone based on achievement of the objectives.

Alberta Innovates continues to require information from the Applicant for five years following the completion of the project in order to measure long-term benefits.

Evaluation Process

All applications are reviewed and evaluated to determine fit with the Carbon Fibre Grand Challenge Phase III objectives and intended outcomes. Alberta Innovates staff and external expert reviewers are engaged to evaluate Applications.

Alberta Innovates evaluates submitted Applications to the Carbon Fibre Grand Challenge Phase III against criteria in three major categories: Innovation, Project Management, and Impacts and Outcomes. The required information for each criterion is detailed in the questions found in the online SmartSimple Application form.

Innovation	Project Management	Impacts and Outcomes
Innovation Opportunity	Work Plan, Tasks, and Deliverables	Economic Impacts & Production of Carbon Fibre in Alberta
Market Opportunity	Budget and Funding Commitment	Environmental Impacts
Proposed Commercialization Pathway	Project Team	Social Impacts
Project Risk Analysis		

Applicants will need to deliver a presentation to the review committee during the week of August 21-25, 2023. Exact presentation dates and times will be confirmed after the application period closes on June 26, 2023.

Alberta Innovates retains the sole right to determine the evaluation process and assessment criteria and does not disclose the names of its reviewers to ensure their objectivity and impartiality. Internal and external parties involved in the evaluation are subject to confidentiality and conflict-of-interest policies set by Alberta Innovates.

All investment decisions are at the sole discretion of Alberta Innovates.

Performance Measurement

Alberta Innovates invests in research and innovation activities on behalf of Albertans to help build a healthier, more sustainable and prosperous future for the province.

To maximize the impact of these investments, our funding is tied to achievement of results and outcomes. For this reason, Alberta Innovates funds on a milestone completion basis. This means the Applicant must submit a Progress or Final Report and demonstrate sufficient progress before Alberta Innovates advances the next milestone payment.

The Investment Agreement outlines the responsibilities the Applicant has in reporting Project outcomes to Alberta Innovates over the course of the Project and following completion of the Project. Outcomes of the Project may be monitored for up to five years after Project completion, so Alberta Innovates can evaluate the economic, social, health and/or environmental benefits to Alberta resulting from our investments.

Alberta Innovates has a common set of performance metrics it monitors, both at the individual Project level and for the aggregate Program. These metrics may evolve over time.



Terms and Conditions

Once we have evaluated and approved an application for funding, Alberta Innovates will require the Applicant to sign our standard-form Investment Agreement. A copy of the Investment Agreement will be posted on the Carbon Fibre Grand Challenge Program website (<https://albertainnovates.ca/programs/carbon-fibre-grand-challenge/>) in May 2023 under the heading “Program Resources”.

The Investment Agreement sets out in detail the roles, responsibilities and obligations of the various Parties to ensure a successful Project. Alberta Innovates will not provide any funding until the Investment Agreement has been signed by all Parties.

Alberta Innovates will only fund Applicants who have satisfied all eligibility criteria. Meeting the eligibility criteria does not guarantee access to funding, and all funding decisions will be made by Alberta Innovates at its sole discretion.

Alberta Innovates will only correspond in writing and provide copies of the Application to the person named in the Application form as the one authorized to speak for the Applicant.

Should you have any questions about this guide or what is expected, please contact Alberta Innovates (see contact information below). Please note that Alberta Innovates may modify this guide from time to time in keeping with any changes to the program.

Contact Information

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