ALBERTA INNOVATES

ALBERTA INNOVATES BUSINESS PLAN

2019-22

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ALBERTA INNOVATES

Acronyms

	Acronym
Accelerating Innovation into CarE	AICE
Alberta Clinical Research Consortium	ACRC
Alberta Health Services	AHS
Alberta Innovates	AI
Alberta Machine Intelligence Institute	Amii
Alberta Manufacturing & Fabrication Innovation	AMFI
Alberta Prion Research Institute	APRI
Alberta Research & Innovation Framework	ARIF
Alberta SPOR Support Unit	AbSPORU
Bitumen Beyond Combustion	BBC
Canadian Energy Pipeline Association Foundation	CEPA Foundation
Canadian Foundation for Innovation	CFI
Canadian Institute for Health Research	CIHR
Canadian Oilsands Innovation Alliance	COSIA
Capital Maintenance & Renewal	CMR
Carbon Capture & Utilization	CCU
Cellulose Nanocrystals	CNC
Clean Research Innovation Network	CRIN
Cleaner Hydrocarbon Production	CHP
Climate Change Innovation & Technology Framework	CCITF
Corporate Planning & Portfolio Management	CPPMO
Digital Energy Technologies	DET
Ecosystems Services & Biodiversity Network	ESBN
Emissions Reduction Alberta	ERA
Executive Business Advisor	EBA
Government of Alberta	GOA
Greenhouse Gas	GHG
Health Research Ethics Board of Alberta	HREBA
Innovative Hydrocarbon Products	IHP
Integrated Service Provider Framework	ISPF
Integration Management Office	IMO
Internet of Medical Things	IoMT
Key Performance Indicator	KPI
Materials and Reliability in Oil Sands	MARIOS

Ministry of Economic Development & Trade	**EDT**
National Centres of Excellence	**NCE**
National Research Council	**NRC**
Natural Resources Canada	**NRCan**
Natural Sciences and Engineering Council of Canada	**NSERC**
Partnership for Research & Innovation in the Health System	**PRIHS**
Performance Measurement & Evaluation	**PME**
Pipeline Research Council International	**PRCI**
Regional Innovation Network	**RIN**
Renewable & Alternate Energy	**RAE**
Research & Innovation	**R&I**
Small & Medium-sized Enterprise	**SME**
Social Sciences & Humanities Research Council	**SSHRC**
Society of Petroleum Engineers	**SPE**
Strategy for Patient Oriented Research	**SPOR**
Technology Development Advisor	**TDA**
Water Innovation Program	**WIP**

ALBERTA INNOVATES

EXECUTIVE SUMMARY

Research and innovation have never played a more important role in the future for Alberta. Our province's ability to build existing industries while introducing new opportunities for growth is critical for our future prosperity. Alberta Innovates enters the 2019-22 business planning cycle well-positioned to advance its strategic priorities for the province. With the amalgamation of four provincial research and Innovation (R&I) corporations largely accomplished, our Corporation now looks toward improving Alberta's innovation outcomes. Our business plan for the next three years drives a focused strategy toward more use of data, digital technologies such as artificial intelligence, clean technology and other emerging tech as innovation platforms for Alberta's key industries and people.

Our mandate and vision are to meet R&I priorities of our single shareholder, the Government of Alberta. Through this, we will foster the development and growth of new and existing industries and small & medium-sized enterprises (SMEs), contribute to environmental performance, and improve the health and well-being of Albertans.

Alberta Innovates is not simply a granting agency; we are a catalyst, convenor and change agent for prosperity. We serve multiple sectors and act as the hub and activator for innovation across the provincial government. Where warranted and of value, we support public and private activities on the path toward commercialization and scale up or end use that benefits Albertans in other areas such as health. Our activity includes and requires a diverse range of collaborations with our many clients and partners, comprising post-secondary institutions, researchers, entrepreneurs, industry, and other R&I agencies and groups. In addition, we engage with technical and program experts in several government ministries, including Advanced Education, Agriculture and Forestry, Economic Development and Trade, Energy, Environment and Parks, Health and Labour. We are working efficiently and effectively to continue to deliver results and leverage the opportunities realized through the Alberta Innovates consolidation. For a sample of results from our 2017-18 Annual Report, see the Results Matter section on page vi.

As the largest and most comprehensive R&I agency in Alberta, we will continue to align our programs and activities to our strategic priorities and the Alberta Research and Innovation Framework (ARIF), as we invest in and contribute to areas of provincial importance. We will continue to stimulate R&I to propel great ideas forward, faster – through funding programs, advice, connections, technical expertise and applied research services. Our multi-pronged investment approach helps drive the innovation agenda and creates pathways that help accelerate R&I to market.

Investments by Alberta Innovates include funding to successful applicants, as well as the expertise, platforms and infrastructure we make available to our clients and other stakeholders.

One of our strategic priorities is to move Alberta R&I toward growth and development in emerging technologies with a particular focus in four areas that demonstrate potential for high return and lower risk:

- Data-Enabled Innovation
- Digital Technology for Business Transformation
- Clean Technology
- Innovative Production & Distribution

We also will focus on our other two strategic priorities – embracing the digital future within our organization and enhancing the province's knowledge workforce:

- By streamlining and automating our internal processes and operations we will make it easier for our clients to interact with us and create operational efficiencies.
- Working closely with partners such as industry and post-secondary institutions, we will help retrain skilled workers, create new training experiences to help Albertans adapt to emerging technologies and the digital future, and we will foster the uptake of trained personnel into new industries. This is fundamental to Alberta's competitiveness in existing sectors, and industrial diversification.

During the coming year and beyond, our program and activity investments will span the R&I continuum from end to end, from discovery to use. We will continue to work in the areas of research, applied research and solutions and commercialization to ensure a cohesive, smart, effective innovation system aligned to Alberta's unique needs and aspirations. We will also continue to work with a wide range of clients, sectors and industries with the aim of helping to support the building of human, infrastructure and platform capacity. We have mapped a client journey to better understand our client needs and how our organization can best support them. Additional key areas of focus in the next year include:

- Our two applied research subsidiaries, InnoTech Alberta and C-FER Technologies (C-FER), will continue to open new markets locally, nationally and globally for their services and work more closely with our other business lines.
- We will finalize and implement a realigned business model for InnoTech Alberta.
- The Research and Innovation Impact Framework being co-developed with the Ministry of Economic Development and Trade will be finished and adopted to help measure our performance and inform our decisions.
- We are well underway with our planning for the next INVENTURE$ event in Calgary this June, building on the success of the inaugural event last year. Attracting thousands of entrepreneurs and investors to Alberta, this event is seminal in boosting the opportunities for innovation and economic growth.

We will continue to be prudent in our program and discretionary spending. We have absorbed a 53 per cent budget cut in the past three years, and since consolidation have worked aggressively to measure the performance of our investments. The rigour, transparency and line of sight to accountabilities and results is front and centre in our culture, and all management and board decisions.

We invite you to look through the Alberta Innovates Business Plan for 2019-2022. It outlines bold new directions aimed at strategically positioning Alberta to realize faster economic growth, better jobs and opportunities, a healthier population and a cleaner environment – not just for this generation but for generations to come.

ALBERTA INNOVATES

Results Matter.

Alberta Innovates delivers results that matter to Albertans.

New jobs, revenue, partnership investments, value-added agricultural and forest products, environmental benefits and cost savings for our health-care system. The results speak volumes about the power of innovation.

The information below is a sample of results from our 2017-18 Annual Report.

We generated $48.6 million in external revenue and industry funding.

Our entrepreneurial investments:

- Supported **570 Alberta technology-based small and medium enterprises** (SMEs) that created **1,560 jobs, 87% of them full time.**
- Generated **$6.40 in SME revenue growth** for every Alberta Innovates dollar invested.
- Generated **$35.66 in follow-on funding** for every dollar we invested; about **80% came from the private sector.**

Our investments also:

- Trained **60 Indigenous pipeline monitors** in Western Canada for leak detection.
- Produced ethanol from municipal solid waste; created **610 direct and indirect jobs** during construction and **150 in operations.** The project generates **$65 million in economic activity per year** while using 120,000 tonnes of solid municipal waste.
- Implemented a new surgical pathway for patients, **reducing wait times by 2.5 days** resulting in **average savings of $4,500 per patient.**

Indigenous pipeline monitors take part in training at the Pipeline Lab, Southern Alberta Institute of Technology.

We have:

- **A world-leading hemp research centre and processing facility** to support Alberta's burgeoning industry. Alberta grew more industrial hemp than any other province. Applications include sound insulation, vehicle parts and construction blocks.

Message from the Board Chairperson

Brenda Kenny, PhD
Chairperson, Board of Alberta Innovates

Two years ago, the provincial government consolidated four organizations into the new Alberta Innovates and tasked us to be the catalyst for economic diversification of this province.

Through the amalgamation, duplication has been eliminated, administrative efficiencies realized and budgets reduced by nearly 53 per cent over three years. Alberta Innovates is generating results with less funding than ever before.

The annual investment of $283 million drives innovation in the province, but there's more to the story. Thanks to our connections across every level and sector of Alberta's economy, our investments create impressive results. For example, every dollar in funding of small and medium enterprises generates $6.40 in revenue growth and $35.66 in follow-on investment, largely from the private sector.

Building on this impressive track record, our aspirational business plan requires Alberta Innovates to attract new investments into the innovation system to achieve the intended objectives. The Board has every confidence that revenues from external investors will be secured and contribute to the achievement of this plan. Nevertheless, it will be critical that adjustments to the expense cap (revenue targets) rules are made to ensure these new investments can successfully contribute to the execution of the business plan. Ultimately, our investments create jobs and grow revenues that support the diversification of our provincial economy.

To sharpen our focus on performance, we are introducing a new measurement approach with this business plan. This will be a vital tool to assess program outcomes and inform resource allocation decisions. As importantly, this new system will generate the evidence that demonstrates our accountability and transparency to Albertans.

New technologies, challenges and opportunities are emerging more swiftly than ever. As well, the nature of business and economic development is different than traditional industries and relies on high-functioning ecosystems of entrepreneurs, investors and fiscal competitiveness. That means the convening power that Alberta Innovates brings to the broader innovation and research system of this province is essential in assuring a sustainable and prosperous future for all Albertans.

ALBERTA INNOVATES

Message from the CEO

Laura Kilcrease
CEO, Alberta Innovates

Technology is enabling us to see beyond the obvious – to find opportunities and solutions previously hidden. Our business plan focuses on emerging technologies that span sectors to strengthen Alberta's businesses and resiliency in an increasingly digitally enabled world. The need to innovate has never been more urgent. The reasons are straightforward.

- Information and technology are changing every aspect of business and community life – from the digital oilfield to predicting outcomes in health – saving money and producing better results.
- Innovative products and distribution technologies make manufacturing more competitive.
- Advanced technologies and processes can generate energy with little carbon impact, mitigate existing carbon emissions, create new value-added carbon products, and remediate environmental impacts.
- Artificial intelligence and machine learning allow massive and complex data repositories to be linked and mined for better decision making, prediction, and efficiency.

According to Domo, a platform provider of cloud-based business intelligence and analytics, the world produces 2.5 quintillion bytes of data daily[1]. Forbes reports that 90 per cent of the world's data was created in the last two years. Alberta Innovates is working to ensure our province gains a strong foothold in the net new economic opportunities this represents.

Over the life of this business plan, we will be convening and collaborating with innovators across the province to activate digital and data technologies in key sectors from health to energy and from rural to urban communities. We will be measuring impacts and outcomes, as we continue to hone and focus actions to deliver optimal returns on investments made. And we will continue to deepen partnerships locally and expand networks across the globe.

Innovation is the pathway to prosperity – and the good news is that Alberta already attracts and produces some of the best talent in artificial intelligence, machine learning and other engineering disciplines. This gives us an advantage that can drive shifts in the economy, create new sectors and build upon the industries that have supported people and prosperity in this province for decades.

Our focus on emerging technologies is priming the pump for sustained competitiveness, jobs of the future and growth of companies that serve world markets from a home base in Alberta. For Alberta, *innovation* never stops.

[1] *Data Never Sleeps 5.0 & 6.0 – tracking studies by Domo.*

Alberta Innovates Business Plan 2019-22
Highlights

We are Alberta's research and innovation engine.

Through collaboration, determination and discovery, Alberta Innovates expands the horizon of possibilities to solve today's challenges, reach new potential and create a healthier, more prosperous future for Alberta and the world.

Our Vision

To be indisputably recognized provincially, nationally and internationally as a leader in catalyzing research and innovation (R&I) in Alberta.

Corporate Goals

- Make the lives of Albertans better today and for generations to come by contributing to a diversified economy, cleaner and sustainable environment, and healthier communities.
- Cultivate a world-class research and innovation system that meets the needs of Alberta.
- Drive the generation of discoveries and developments that positively impact Alberta and its industries by leveraging partnerships, collaborations and emerging technology platforms.
- Accelerate and broaden the use of innovative products, technologies and processes.
- Be recognized globally as a leading innovation engine.

Our Value to Alberta

As a catalyst for accelerating innovation

We are the largest research & innovation agency in Alberta. We are uniquely positioned to propel great ideas forward, faster through our programs, services and expertise. Our end-to-end approach helps guide our clients through the innovation journey – helping them succeed (or fail) faster and gather important market-driven evidence along the way.

As a partner and collaborator

With our extensive partnerships, collaborations and networks, we help ensure our clients are connected with the right resources at the right time. We have leading-edge facilities and on-site research capabilities to test, scale and validate ideas and prototypes.

As a convenor and connector

We connect R&I system players to reduce barriers and increase the adoption and spread of innovations. We bring together inventors, investors and thought leaders at INVENTURE$ to discover and share the latest in innovation, research, capital access, deal-making and experiential learning.

ABOUT US

640 EMPLOYEES

11 LOCATIONS

2 SUBSIDIARIES

- InnoTech Alberta
- C-FER Technologies

Investment of $282.8 million for 2019-20

68 PROGRAMS
in 17 investment portfolios

Alberta Innovates supports R&I aligned with Government of Alberta priorities outlined in the Alberta Research and Innovation Framework (ARIF). Our activities and impacts contribute to work in many areas of government and by our partners.

Alberta Innovates Business Plan 2019-22
Highlights

Our Strategic Priorities to Drive Innovation

We are shifting our investment portfolios towards the three R&I priorities identified in our five-year strategy. These priorities capitalize on Alberta's current strengths while leveraging innovations with the highest promise.

Develop Emerging Technologies

Facilitate the growth and development of emerging technologies in Alberta that have demonstrated potential for high return and lower risk, with a focus on four core areas: Data-Enabled Innovation, Digital Technology for Business Transformation, Clean Energy and Innovative Production and Distribution. Some of our activities:

- Bioresource Information Management System
- Alberta Data Institute
- Internet-of-Things for health applications
- Alberta Machine Intelligence Institute
- Bitumen Beyond Combustion
- Geothermal Energy
- Alberta Smart Grid Consortium
- Smart Agriculture and Food

Enhance Our Knowledge Workforce

Working with post-secondary partners and others, we will play a key role in helping build and accelerate new training that enables Albertans to adapt to emerging technologies and the digital future. We will encourage uptake of trained personnel into new industries. Some of our activities:

- Develop graduate students and post-doctoral fellows
- Entrepreneurial education and training programs
- Support for industry-academic collaborations

Embrace the Digital Future

We will streamline and automate our processes and operations to ensure clients have more seamless access to our programs and services. Some of our activities:

- Streamline our systems for better co-ordination of our activities
- Improve our decision-making speed
- Enhance our ability to course-correct our operations

The Alberta Innovates Client Journey

Our clients engage with us at any point along the client journey where they feel we can help. Not only do we assist in the early stages of an idea or concept, but also when validating and scaling is required or to help them explore global markets and partnerships as their innovations mature.

INTRODUCTION

We are Alberta's research and innovation engine. Through collaboration, determination and discovery, Alberta Innovates expands the horizon of possibilities to solve today's challenges, reach new potential, and create a healthier, more prosperous future for Alberta and the world. Through strategic investments, world-class research and leading-edge testing facilities, we won't just be found in one place, one thing or one idea. We are Alberta Innovates…solving problems, creating possibilities.

VISION AND MANDATE

Our vision is to be indisputably recognized provincially, nationally and internationally as a leader in catalyzing research and innovation (R&I) in Alberta. We have a clear mandate, summarized in Figure 1, that drives our actions, programs and initiatives. Working within the mandate set by the Government of Alberta, we carefully steer the innovation system to bring benefit to Albertans.

FIGURE 1
Alberta Innovates Is…

CORPORATE ACCOUNTABILITY

Alberta Innovates (AI) was created as a provincial corporation under the Alberta Research and Innovation Act to support R&I activities aligned with Government of Alberta priorities, "including activities … directed at the discovery, commercialization and application of knowledge." AI has two applied research subsidiaries – Innotech Alberta and C-FER Technologies (C-FER).

We are governed by an appointed board and report to the Minister of Economic Development and Trade. Most of our activities are funded in large part through the Ministry of Economic Development and Trade (EDT) from a budget approved by the Legislative Assembly. We receive additional funding from other provincial and federal government entities, industry, non-governmental organizations (NGO), and we also generate revenues through contract research activities. Our activities and impacts contribute to work being done in several areas of government and by our partners.

CORPORATE GOALS

Our corporate goals, which guide us in shaping this business plan and our internal operating plans, are to:

- Make the lives of Albertans better today and for generations to come by contributing to a diversified economy, cleaner and sustainable environment, and healthier communities.
- Cultivate a world-class research and innovation system that meets the needs of Alberta.
- Drive the generation of discoveries and developments that positively impact Alberta and its industries by leveraging partnerships, collaborations and emerging technology platforms.
- Accelerate and broaden the use of innovative products, technologies and processes.
- Be recognized globally as a leading innovation engine.

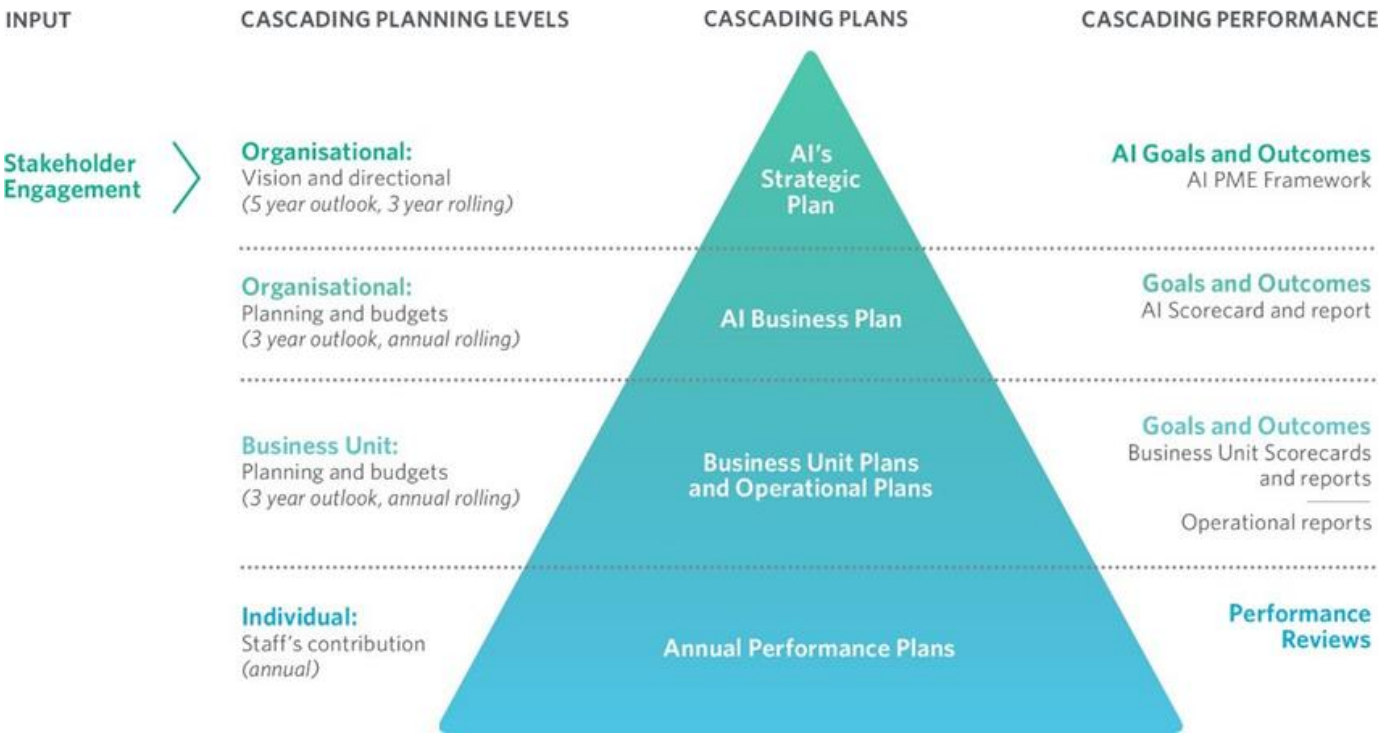
As illustrated in Figure 2 below, cascaded and interconnected relationships exist between our corporate goals, our five-year strategy, business plan, business line operating plans and staff annual performance plans. These planning activities are accompanied by cascaded performance management and reporting at each level. (See the **Performance Management** section for additional details).

Throughout this business plan, AI's actions and investments for achieving our corporate goals align to the **Alberta Innovates Five-Year Strategic Plan** and the **Alberta Research and Innovation Framework (ARIF)**[2]. For more detail on our alignment with ARIF, see Contributing to ARIF Outcomes on page 18.

[2] https://www.alberta.ca/alberta-research-innovation-framework.aspx

FIGURE 2

AI's Cascading Planning Levels and Performance Management



FIVE-YEAR STRATEGY

Our five-year strategic plan reflects insights gathered through extensive provincewide consultations with stakeholders across the R&I continuum. It is also based on research into global best practices with applicability to Alberta.

Technology is applying science to solve a problem.

Through these consultations we learned that 80 per cent working in technology fields identified better utilization of technology as the "best opportunity" for growth. But there also was a recognition that Alberta has lost ground in its ability to compete in a technology-driven economy. Traditional industries and emerging sectors also identified technology gains as an important need. This stakeholder feedback is supported by international data – the impact of rapid technological change on growth is a significant concern for 38 per cent of global CEOs.[3] It is forecasted that technology platforms will enable two-thirds of digital technology value creation – an area that could generate $100 trillion in value to industry and society globally by 2025.[4,5] Within Canada, 42 per cent of our workforce over the next 20 years could be impacted by technologies such as digitization and automation.[6]

[3] PwC. (2018). 21st CEO Survey: The Anxious Optimist in the Corner Office.

[4] World Economic Forum. "Digital Transformation Initiative: Unlocking $100 Trillion for Business and Society from Digital Transformation" January 2017.

[5] IBID.

[6] Creig Lamb. (June 2016). *The Talented Mr. Robot: The impact of automation on Canada's workforce*. Brookfield Institute for Innovation and

Our strategic planning process[7] revealed that Alberta currently has a deficiency in the talent and workforce capacity needed for large-scale commercialization and expansion in many sectors; our talent capacity in key technology occupations is well below peer levels in other jurisdictions. This can be partially addressed by strengthening higher education programs in computer science, mathematics and statistics relative to global peers. Essentially, the workforce of the near future will require vastly different skills and knowledge than the workforce of today.

We recognize no single technology or industry will sufficiently transform and diversify our economy – instead, a convergence of emerging technologies, platforms and applications must be applied to solving problems. We further recognize that the collision of research discoveries and emerging technologies is how new industries are discovered, built and grown. Developing new industries, combined with our existing strengths, will diversify our economy and insulate Albertans from resource sector economic swings.

We have come to appreciate the use of data, digital technology and artificial intelligence to shift innovation within Alberta Innovates and provide seamless business operations for our benefit and that of our clients. Our key initiatives, programs and services will focus on the opportunities within these strategic priorities.

Strategic Priorities to Drive Innovation

Our five-year strategy charts a course to align our investments and business lines with three R&I priorities:

- **Develop Emerging Technologies:** AI will facilitate the growth and development of emerging technologies in Alberta that have demonstrated potential for high return and lower risk, with a focus on four core areas as outlined in Figure 3.
- **Enhance Our Knowledge Workforce**: Working with our post-secondary partners and others, we will play a key role in enhancing the province's knowledge workforce by collaborating to help build and accelerate new training that will enable Albertans to adapt to emerging technologies and the digital future. We will encourage uptake of trained personnel into new industries.
- **Embrace the Digital Future**: We will streamline and automate our internal processes and operations and ensure target clients are aware of and have seamless access to our programs and services.

[7] Stone-Olafson & Market St. (2018). Draft Economic Growth Through Innovation Strategy, Alberta, Canada.

FIGURE 3
Four Core Emerging Technology Areas

Data-Enabled Innovation

Transforming data into actionable information enables digital transformation.

Digital Technology for Business Transformation

How we leverage technology to sense and measure information across enterprise is changing the way we live and conduct business.

Clean Technology

The sustainability of our planet necessitates innovation for a low carbon future

Innovation Production and Distribution

In a globalized economy, product innovation and access to market is critical to competitiveness and continued prosperity.

We will continue to support the full R&I continuum, from discovery to use (see Appendix A), in the areas of: health; energy and greenhouse gas (GHG) mitigation; environment and climate adaptation; food and agriculture; and development of bioindustrial products and technologies. Many existing post-secondary, business and industry research programs will be unchanged. At the same time, we will begin to shift our investment portfolios away from sector-specific initiatives and move toward fostering development of emerging technologies in several sectors and focus on innovations that serve multiple sectors. This is intended to capitalize on Alberta's current strengths while leveraging technologies with the highest promise.

Alberta Innovates interacts and connects with a complex "system" of interconnected innovation organizations and individuals – collectively the Albertan "research and innovation system."

The addition of emerging technologies to our portfolio of investments will help Alberta to become future-ready. These broad technologies break down silos between industry and institutions, and foster collaborations across sectors with public, private and post-secondary stakeholders. Moreover, applying emerging technologies across sectors optimizes impact by connecting Alberta's R&I system to the market. This will help to better position Alberta to compete in a digitally transformed, globalized economy.

The section called **Evolving for Continued Success** provides further insights into how we are implementing our three strategic priorities.

OUR VALUE TO ALBERTA

Innovation is the application of new knowledge or technology to solve a problem. Innovation systems work to create fluid, trusted interactions between people and services to increase the speed of knowledge sharing, and the collisions of ideas."

Alberta Innovates is the largest research and innovation agency in the province. The consolidation of Alberta Innovates in 2016 provided us with a new and invigorated mandate to help steer the R&I system to bring benefit to Albertans. Prior to consolidation, the sector-focused strategies worked in isolation. Now, Alberta Innovates is better positioned to stimulate R&I to propel great ideas forward, faster across the R&I continuum through our programs, services and expertise. Since we also work with a range of sectors and industries, we have a unique role and place in the R&I system. The breadth of our activities provides us with a wide-angle lens that allows us to identify opportunities, challenges and gaps where R&I can help provide solutions.

A strong R&I system exists to increase the quantity and quality of new discoveries, conduct applied research and to speed up adoption and commercialization.

As we look at our national and global partners and competitors, cohesive innovation enterprises like Alberta Innovates are providing governments with a way to stimulate innovation and related economic outcomes.[8-10]

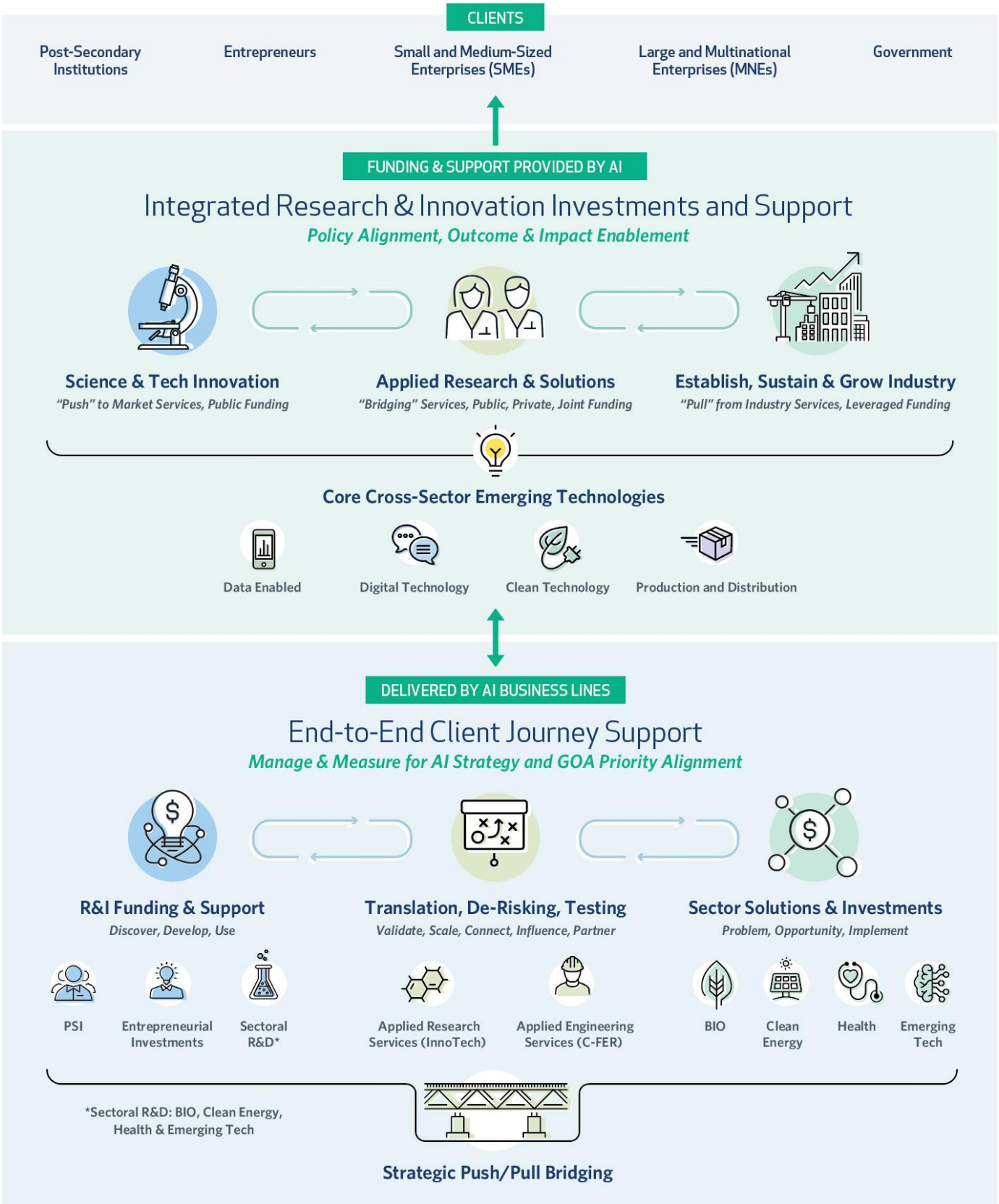
Vaulting a great idea to commercialization or end use is the most challenging aspect of innovation. We have expertise, leading-edge facilities and on-site research capabilities to test, scale and validate ideas and prototypes and accelerate our clients' innovation journey. Alberta Innovates' approach to our R&I support activities ensures that we can achieve more impactful outcomes from our portfolio of investments. Our efforts to improve co-ordination within the innovation system and with our strategic partners in government, industry and academia underpins our investment strategy. We act as a convenor and connector; we bring together inventors, investors and thought leaders at our annual INVENTURE$ event to discover and share the latest in innovation, research, capital access, deal-making and experiential learning.

Alberta Innovates' Integrated Service Provider Framework shown in Figure 4 illustrates our end-to-end approach for providing the required leadership, co-ordination and support services across the R&I continuum to deliver on our provincial R&I priorities. It also highlights how our investments are dispersed to support the development of new knowledge, new technology, new business and new industry solutions.

[8] UK Research and Innovation (UKRI). https://www.ukri.org/
[9] Commonwealth Scientific and Industrial Research Organisation (CSIRO). https://www.csiro.au/
[10] Research Manitoba. https://researchmanitoba.ca/

FIGURE 4

Integrated Service Provider Framework (Draft)



At one end – the "push" side of the R&I system – we focus our investments on the building of research capacity, innovation culture, talent supply and research infrastructure. The competitive funding opportunities and supports that we provide assist our clients in moving ideas to commercialization or use. At the other end, our investments support the development and delivery of innovations that meet industries' "pull" for practical solutions to their biggest challenges. Through these solutions, Alberta Innovates helps establish, sustain and grow industry in the province. The world-renowned applied research and engineering services provided by our subsidiaries – InnoTech Alberta and C-FER Technologies – provide a critical "bridge" by de-risking, testing and translating innovation through applied research capabilities and capacity. This increases the odds for successful commercialization and use in the market for those on the "push" side. It also accelerates access to new ideas and innovative solutions to address industry's challenges in the province on the "pull" side.

End-to-end client journey support is provided by our highly specialized business lines. These operational areas are the engines that drive us toward achievement of our corporate goals and the implementation of our five-year strategy. Our business lines consist of:

- **Bio**: Provides leadership and co-ordination for activities that support the growth and diversification of Alberta's agriculture, forestry and food sectors.
- **Clean Energy**: Develops and invests in applied R&I programs to sustain, grow and diversify the energy and resource industries, develop clean technology, reduce greenhouse gas emissions and protect the environment in Alberta.
- **Emerging Technologies**: Co-ordinates and develops emerging technology activities across our Corporation, to ensure application in multiple sectors. Provides expertise in the four core emerging technology areas to augment sector expertise in our other business lines.
- **Entrepreneurial Investments**: Assists individual entrepreneurs and high-growth, high-potential SMEs to reduce the time it takes to commercialize novel technology and knowledge-based products, and to scale their business.
- **Health Innovation**: Delivers a robust R&I portfolio that engages clients and provides supports and services across the innovation spectrum, with the aim of building a strong and resilient R&I health ecosystem for a healthy population.
- **Post-Secondary Investments**: Invests in Alberta's post-secondary institutions to strategically develop capacity in people, key infrastructure, collaborations and projects necessary to create innovative solutions within emerging technology areas of Alberta's knowledge-based economy.
- **C-FER Technologies**: Provides applied engineering services and testing to advance safety, efficiency and environmental performance in partnership with the energy industry.
- **InnoTech Alberta:** Provides unique expertise and infrastructure that basic, applied and industry researchers can leverage to develop new technologies and solve problems, thereby acting as a bridge between early research and industry.

Appendix B provides additional information about our business lines, including their key actions for 2019-22 and alignment to our corporate goals.

EVOLVING FOR CONTINUED SUCCESS

IMPLEMENTING OUR FIVE-YEAR STRATEGY

There are significant challenges facing our province that directly affect the well-being of Albertans. Our economy has traditionally been heavily reliant on the energy sector which leaves the province vulnerable to swings in resource prices and overseas market access. Through innovation, we can build a more resilient and diversified economy by generating more value from our hydrocarbons and renewable resources, and we can better support the health and well-being of Albertans and the health of our planet.

Alberta Innovates will continue to be prudent in our program and discretionary spending while managing within the limits of our allotted budget. The past three years have seen us absorb a 53 per cent budget cut, and since our amalgamation, we have worked aggressively to measure the performance and impacts of our investments. We are accountable and transparent in our investments and processes – this is the cornerstone to our culture, management and board decisions.

Over the next three years, Alberta Innovates is intensifying the implementation of our five-year strategy. We will be continuing work begun by our legacy organizations that remains aligned to our current strategy, including activities related to emerging technologies at the forefront of science and engineering.

Develop Emerging Technologies

Appendix C provides details of initiatives currently underway or on the horizon that our business lines are undertaking to develop emerging technologies in our four core areas. Here are some highlights:

Emerging Opportunities for Better Health and Health Care

We will look at opportunities in emerging technologies that increasingly focus on a comprehensive view of health and health care – including the social determinants of health – and support a continued shift towards enhanced care in the community. This aligns to consumer and digital trends that have already affected other sectors. Emerging opportunities will include development of machine learning models to predict clinical outcomes, virtual models to guide patients in self-management and the prevention of disease through healthier lifestyles, and improving upon platform technologies, secondary use data and programs for digital health. Key developments in this area have been the formation of the Alberta Data Institute, a reformulation of our investment strategy to shift towards digital health and data innovation, and the development of enablers that support a strong integrated, innovation and health economy.

Commercializing New Technology

We intend to align our commercialization efforts across the corporation to optimize our progress toward our strategic priorities. We will continue to investigate leading concepts, nascent and

emerging technologies, applications and practices in our strategic focus areas. Internal expertise in emerging technologies will help guide the analysis of our existing activities in this area to identify our strengths and areas of opportunity. Our work to encourage leading support practices for digital and emerging technology firms will continue with an emphasis on growth and scale.

Harnessing Technology in the Bio Space

New programming will target "Smart Agriculture and Food" through data-enabled innovation, data for business transformation or innovative production processes to accelerate productivity, profitability and global competitiveness. New competitions within our bioindustrial programs will more fully incorporate digital data acquisition, digital technology, clean technology and innovative products capable of positively impacting Alberta industry. The nature of the work around environmental markets will continue to focus on geospatial data, platforms and emerging technologies.

Advanced Manufacturing and Artificial Intelligence

In addition to supporting people and projects in emerging disciplines, we will continue to provide support for facilities that enable emerging technology companies to develop novel products using advanced manufacturing equipment in industries, including sensors, autonomous systems, robotics and quantum technologies. One significant opportunity lies in the field of artificial intelligence. Through the Alberta Machine Intelligence Institute (Amii), Alberta has risen to a high level on the global stage, producing some of the top technologies, discoveries and talent. We have supported this organization and technology area since 2002 and, with additional investment from the Government of Canada and numerous industrial partners over the last year, the opportunities for Amii are greatly expanding. There is now much greater potential to support the translation of knowledge generated by Amii to solve challenges for both large and small Alberta companies. Alberta Innovates will continue to support this initiative and expand its program offerings to ensure the gaps that might arise in this rapidly developing field are covered.

Environmental Sustainability Through Emerging Technologies

Several initiatives are also underway in Alberta Innovates to better align to emerging technology opportunities in the area of environmental sustainability. The Bitumen Beyond Combustion program will advance R&I that converts bitumen into high-value, non-fuel products. This program, along with our Bitumen Partial Upgrading Program, add value in Alberta by diversifying products, enhancing market access and reducing GHG emissions. We will continue to actively develop a digital energy technologies initiative that aims to improve efficiency and competitiveness of the oil and gas industry, as well as an initiative that focuses on effective remediation of legacy oil and gas sites in Alberta. Additionally, we will continue our work as a member of the Alberta Smart Grid Consortium to the accelerate of the development and deployment of smart grid technologies in Alberta. The creation of this 11-member industry consortium was led by Alberta Innovates.

Emerging Technology Solutions for Industry Clients

Our subsidiaries continue to work to open new markets locally, nationally and globally, and are exploring ways to incorporate the emerging technology priority areas with their client base. Incorporating emerging technology solutions such as optics and photonics across major sectors (e.g., transportation, aerospace, agri-food, industrial processes, natural resources, etc.) ensures that InnoTech is a key player in accelerating technology adoption capable of generating positive impacts on Alberta's economy. C-FER is leveraging its expertise in oil and gas technologies to identify emerging opportunities in geothermal energy and the building of integrity management solutions for oil, gas and pipeline operators.

Enhance the Knowledge Workforce

We are also focusing on building capacity in Alberta to support the development and adoption of emerging technologies. These initiatives will include advancing the development of a provincial workforce with enhanced knowledge in the areas of data-enabled innovation, digital technology for business transformation, clean technology, and innovation production and distribution. This will accelerate Alberta's transformation to a digital future and will help establish Alberta Innovates as a leader in R&I.

We remain dedicated to enhancing Alberta's knowledge workforce through the development of graduate students and post-doctoral fellows through work on specific projects with defined outcomes that create benefits for Albertans and our industries. This includes the Alberta Prion Research Institute (APRI), which supports fundamental and applied research projects that take an interdisciplinary approach to solving the mysteries of prion and protein misfolding. Other examples include providing support for entrepreneurial education and training programs, as well as programs that support industry-academic collaborations such as the MITACS internship program.

To capitalize on the strategic shift to our priority areas, InnoTech Alberta is educating staff, acquiring new expertise and setting up infrastructure that will allow it to be a provincial leader and a one-stop shop for information in these areas.

Embrace the Digital Future

An Integration Management Office (IMO) was established in Alberta Innovates in September 2018 to assist with our optimization efforts. In addition to applying a strategic lens and project management focus to our integration activities, the IMO helps ensure an internal, operational focus on embracing the digital future. This will include the systematic implementation of several initiatives across the Corporation that will streamline our systems and processes to better co-ordinate client activities between business lines, improve our decision-making speed and enhance our ability to course-correct at the business line and organizational levels. These initiatives will optimize the use of our resources. Other areas of focus will include enhanced internal and external communications with stakeholders and the public.

Our clients engage with us at any point along the client journey where they feel we can help (see Figure 5). Not only do we assist in the early stages of an idea or concept, but also when validating and scaling is required or to help them explore global markets and partnerships as their innovations mature.

To improve clients' experience with us, we are actively working to streamline how they access our programs and services. This includes developing more sophisticated business approaches to better co-ordinate and manage client interactions throughout AI and our subsidiaries. We will also draw upon our internal scientific and technical capabilities, business and commercial know-how and perspectives on emerging technologies – as well as those of our partners – to provide clients with critical expertise and insights to guide them during their journey.

Our clients include – students, researchers, entrepreneurs, governments and government agencies, health professionals, not-for-profit organizations, small and medium-sized enterprises (SMEs) and large companies – who access Alberta Innovates funding, services and expertise.

FIGURE 5

The Alberta Innovates Client Journey

(Adapted with permission from startupcommons.org)

OPERATIONAL CO-ORDINATION

We are continuing to work toward greater co-ordination and integration of our programs and services. We seek or develop linkages between our business and operational areas, so that our investments are co-ordinated and the client hand-off through the R&I cycle becomes seamless. Further integration will help balance our investment portfolio toward priority areas, identify high-potential opportunities and enhance our ability to be nimble, responsive and market-driven. As we do so, we will take into consideration scientific, technical and business feasibility, risks and rewards, sector needs, and various insights gathered through market intelligence initiatives. At all times, we will ensure our resources are invested with transparent, accountable and fair processes.

Increased interaction between our business lines will assist in identifying opportunities for integrating emerging technologies, knowledge and people into the province's economic sectors. This includes areas such as precision medicine, advanced materials, smart food production, clean tech, digital oilfield and alternative energy systems. An area of significant opportunity that can be addressed through our integration is bridging the gap between our

investments at post-secondary institutions and the transition of the people, knowledge and technologies into industries. Over the period of this business plan, our Post-Secondary Investments team will continue work closely with Entrepreneurial Investments to develop and deliver programs and services to help ensure there is uninterrupted progress through the client journey for post-secondary institute clients.

Purposeful co-ordination and integration of our business lines also allows us to pursue areas of interest across sectors. Realizing the health impacts of clean energy initiatives and food that improves the health of Albertans. It provides significant opportunities for the expertise within Entrepreneurial Investments to be used across the organization to assist in bringing new technologies to market in areas such as agriculture, food, health and clean energy. The building of digital innovation hubs and access to health systems globally requires increased collaboration between Health Innovation and Entrepreneurial Investments.

Other examples:

- The successful delivery of the Climate Change Innovation Technologies Framework (CCITF) and Emissions Reduction Alberta (ERA) programs will continue to benefit from active collaborations between our Bio and Clean Energy business lines.
- Entrepreneurial Investments will also seek to leverage its programs to develop new client-centric partnership projects between our business units, subsidiary companies and Alberta SMEs.
- Valuable knowledge and insights gained by the Health Innovation business line on the building of collaborative networks with be shared with Bio to assist the work in this area.
- Our ongoing focus on integration will see us working more closely with InnoTech Alberta and C-FER along the client journey to develop and accelerate new technologies. Opportunities for health innovation will be explored that leverage existing InnoTech and C-FER platforms, such as computation simulations and sensor development. InnoTech Alberta's business model will also be leveraged to inform a sustainable Alberta SPOR Support Unit.
- InnoTech is involved in the facilitation of industry challenges such as the Lignin Challenge for the Bio business line – a value-add funding program to promote the use of lignin, a forestry byproduct, in bioproducts. Collaborative work with InnoTech Alberta to develop applications for cellulose nanocrystals (CNC) and lignin will continue. New opportunities for collaborating on hemp and marijuana research prospects will be explored.
- InnoTech Alberta and C-FER can also meaningfully contribute to Clean Energy's initiatives in digital oilfield, bitumen beyond combustion, and abandoned wellsite reclamation. While our subsidiaries approach Alberta Innovates as another client whose specific goals and targets need to be achieved, they also help inform investment decisions within Alberta Innovates granting processes by providing subject matter expertise.
- Further integration between Alberta Innovates and our subsidiaries also provides significant benefits to our clients and stakeholders by connecting them with applied research expertise and resources. This is currently being demonstrated in our Ecosystem Services and Biodiversity program and Strategic Research Program (SRP). The latter helps academic research scale up from the lab to field scale using InnoTech Alberta's infrastructure.
- Stronger integration between C-FER and InnoTech initiatives such as Materials and Reliability in Oil Sands (MARIOS), AACI research program, and Alberta Manufacturing and Fabrication Innovation (AMFI) programs, can provide large-scale testing and engineering services to Alberta industry.
- Closer relationship between the Regional Innovation Networks (RINs), Entrepreneurial Investments, InnoTech Alberta and C-FER will better support entrepreneurs in commercializing their technologies by connecting them

with applied engineering services and industry end users. Benefits for our subsidiaries can be generated through increased connection to the emerging technologies capacity developed in Alberta's post-secondary institutions through our past and current programs such as MITACS.

ACCELERATING INNOVATION

We are uniquely positioned in Alberta to help move innovations through the R&I system in the province at an accelerated rate. Our investments, connections, platforms and expertise are leveraged to help guide our clients through the innovation journey – helping them succeed (or fail) faster and gather important market-driven evidence along the way. With our existing cross-sectoral R&I partnerships and collaborations, we help ensure our clients are connected with the right resources at the right time. As a convenor, we bring together R&I system players to reduce barriers and increase the adoption and spread of innovations.

The following illustrates some of the ways we are currently working with our partners and clients move their innovations to market faster:

- Partnerships and collaborations decrease the time it takes to develop a product and get it to the end users for testing and refinement and finally to the market:
  - We have built a strategic partnership with Alberta Sulphur Research Ltd., Husky Energy and CanmetEnergy to accelerate the development of the Husky Diluent Reduction (HDR) process.
  - We have partnered with Hexion Inc. to accelerate the development of engineered panel products that utilize Alberta's sustainable, renewable resources.
  - In an effort to change the way pipeline operating companies deal with oil leaks, C-FER has been working alongside Total Containment Inc. (TCI) to develop a rubber-impregnated wrap for containment.

- Through our support for R&I system platforms and services we are working with clients to reduce barriers, create connections, provide expertise and ensure they have access to the resources they need in a timely manner:
  - We are leveraging the expertise and connections of our TDAs into the greater innovation community to speed up the commercialization process and ensure we are getting the entrepreneurs and SMEs what they need, when they need it.
  - We are leveraging the EDGE Research Management tool to track and produce business intelligence of clinical health research in the province, In collaboration with our partners, AHS and Covenant Health.
  - Our Post-Secondary Investments business line works closely with Alberta academic institutions to close the gap between scientific and technical discoveries and the deployment of the knowledge and technologies in industry.

STRATEGIC PARTNERSHIPS AND COLLABORATIONS

Alberta has several complex challenges to solve to sustain the economic, environmental and social prosperity necessary for national and international success. These challenges are best addressed through the R&I system as it adapts and evolves to meet the changing needs of Alberta. We contribute to this system by working closely with a variety of partners and collaborators in government, academia and industry and elsewhere to design, deliver and evaluate programs and services that help achieve R&I excellence for Albertans.

Our network-based system of partners and service providers work based on a shared understanding of overarching goals and purpose. Alberta Innovates serves as a leader, influencer, convenor and connector. Our understanding of system-level impact drives us to work with others to build an informed community and increase support for the implementation of new knowledge, discoveries and technologies capable of addressing the province's challenges of today and tomorrow. Further, our relationships with governments and the private sector enhance AIberta's position as globally competitive in the emerging technology areas.

Alberta Innovates will continue to participate in and foster partnerships and collaborations aligned to our business, for the mutual benefit to all those involved.

Some of our key partnerships and collaborations are described below.

PROVINCIAL PARTNERSHIPS

The Government of Alberta enables R&I through policy implementation and budget allocations. Our partnerships with the Government of Alberta ensure that we launch opportunities that are Alberta-specific and aligned to provincial R&I priorities and initiatives It also affords our organization with opportunities to inform the development of provincial R&I policies, better understand the market needs within and outside our borders and share our technical expertise. In addition, we engage with the technical and program experts in several government ministries, including Advanced Education, Agriculture and Forestry, Economic Development and Trade, Energy, and Environment and Parks, Health and Labour. We also support EDT in identifying opportunities to attract investment to the province by foreign government owned entities and energy industry operations. We work closely with EDT to promote Alberta technologies and services in the oil, gas and pipeline industries in foreign markets.

The co-development, co-funding and/or co-delivery of programs with government and other provincial entities, such as Alberta Health Services help reduce duplication while maximizing the impact of R&I for Albertans.

FEDERAL PARTNERSHIPS

Federal agencies are important partners whose funds and networks can be leveraged by Alberta Innovates to develop national and international research and development collaborations and industry partnerships. Opportunities exist to develop collaborations examining potential impacts from development and adoption of emerging technologies, including ethical, environmental, economic, legal and social issues. Awareness and

management of these issues are important for reducing the barriers to social acceptance and translation to society while increasing value to Albertans and Canadians.

INDUSTRY PARTNERSHIPS

Industry and industry associations play a vital role in Alberta's economy, creating economic diversity and strength for Albertans. Alberta Innovates actively seeks industry partnerships that work toward the development of new programs, services, treatments and commercial products, including those that aim to solve the Government of Alberta's Grand Challenges. Industries can discover and adopt new science and technologies faster when these partnerships are used to link Alberta's entrepreneurs, SMEs and post-secondary institutions to industry, a benefit that can move industry to the next 10 to 20 years of productivity. At the same time, those who connect with industry develop a better understanding of the issues faced by industry and may find opportunities to prove their innovative technologies. Partnerships with industry and industry associations also provide Alberta Innovates with funds, in-kind resources and expertise that assist us in advancing innovative products while helping to reduce risks for both partners. Our subsidiaries also contribute to several industry associations by serving on technical committees, contributing to new industry standards and organizing technical conferences.

The valued relationships that we have created with many of our industry clients and their associations often result in them becoming long-term partners and collaborators in ongoing research and development.

POST-SECONDARY PARTNERSHIPS

Post-secondary institutions are critical delivery agents of people, knowledge and technologies to the broader R&I system. They are leaders in building and sustaining global networks and connect Alberta to a global pool of knowledge and talent at the forefront of science and technology around the world. In partnership with Alberta Innovates, these assets can provide greater understanding of emerging technology trends at the global scale, and they can be used to bring the best and brightest personnel to Alberta to address our existing challenges. They also provide the province with critical expertise and infrastructure to create and develop cutting-edge ideas. Our partnerships with post-secondary institutions enable us to support the development of highly qualified personnel through project funding in strategically relevant areas such as emerging technologies. We also support research within post-secondary institutions that will lead to early-stage technological solutions to industrial and societal challenges, leveraging industry investments in areas of shared research priorities when possible. In addition to funding support, post-secondary institutions gain access to our broad networks and receive support for knowledge translation to industry and the health system.

Ad-hoc collaborations also occur between our subsidiaries and post-secondary institutions. Often these are designed to leverage expertise or advanced equipment not readily available at InnoTech or C-FER facilities. Our subsidiaries are working to strengthen and formalize relationships with several post-secondary institutions in the near future.

OTHER KEY PARTNERSHIPS

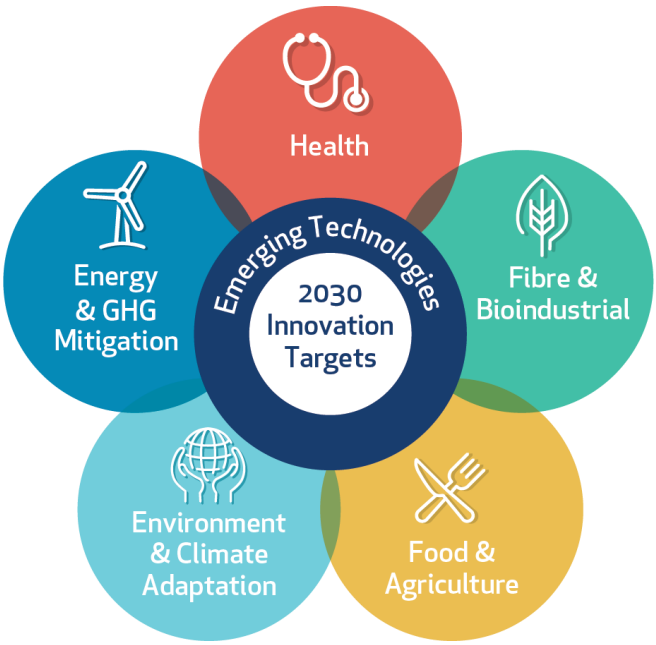
Our partnership with the SME community provides a conduit for moving knowledge, people and technology in the economy. Additionally, Alberta Innovates works with a network of private incubators, accelerators, angel investors and venture capital groups to develop access to knowledge and capital for our entrepreneurial and SME clients.

Alberta Innovates also maintains several partnerships with not-for-profit organizations, consortia, associations and networks in all sectors and including specific partnerships with jurisdictions globally.

CONTRIBUTING TO ARIF OUTCOMES

The Alberta Research and Innovation Framework (ARIF)[11] focuses the work of government, provincially supported R&I organizations and post-secondary institutions on the needs of Albertans through established outcomes and aspirational innovation targets (see Figure 6). The clear direction provided by ARIF helps inform our strategic and business planning. It also empowers us to continue to work together with other stakeholders to contribute to transformational solutions in priority areas that ensure sustainable economic, environmental and social prosperity for the province.

FIGURE 6
ARIF 2030 Innovation Targets[12]



Alberta Innovates contributes to the ARIF innovation targets in multiple ways through our diverse suite of programs and services in various sectors and across the R&I continuum. In relation to the **Energy and GHG Mitigation** targets, we are working with our industry partners, industry associations and the federal government to support innovations that will help industry meet the 45 per cent methane reduction targets and oil sands emission cap. Several new technologies and processes that we are validating will also reduce GHG emission for oil sands production and improve oil sands efficiency. To increase value and market access, we are assisting industry advance bitumen partial upgrading technologies and are helping build confidence in pipeline operations through work in leak detection system performance, inland spill response, and advanced pipeline design methods. Alberta Innovates is also advancing renewable energy in the province through the evaluation of waste heat recovery systems, the adaptation of oil and gas technologies to geothermal and through our work on energy storage with the Alberta Smart Grid Consortium that will enable more renewable energy to come to Alberta's electric grid.

[11] https://www.alberta.ca/alberta-research-innovation-framework.aspx.
[12] https://www.alberta.ca/assets/documents/arif-report.pdf

We contribute to the **Health** innovation targets by improving the quality of care and reducing the burden of disease through our partnerships and initiatives in health system improvement, transitions in care and chronic disease management. The robustness of health data will be improved through the work of the Alberta Data Institute, the Alberta Prion Research Institute (APRI) and through our partnership with Alberta Health for cancer screening R&I. Several of our initiatives are accelerating health and wellness innovation by increasing the implementation and spread of SME-owned technologies in the market, supporting Alberta's ability to grow and sustain new globally relevant health markets (e.g., precision health and cannabinoids) and accelerating digital innovation into care.

Alberta Innovates contributes to the **Fibre and Bioindustrial** innovation targets by increasing sales and driving investment in these areas. For example, we are reducing waste and providing opportunities for value-added products through bioindustrial investments that enhance biomass utilization in the province. Other investments help achieve the **Food and Agriculture** innovation targets by increasing revenue in food and beverage manufacturing, improving productivity of Alberta arable land, ensuring that Alberta meat products are of the highest quality and enhancing public trust in Alberta's food production systems.

To help advance sustainable water management as part of the **Environment and Climate Adaptation** innovation targets, our Water Innovation Program (WIP) has helped Alberta exceed the ARIF target for water use efficiency. Through our subsidiaries, we are leading the development of spill response technologies for inland waterways and, in partnership an industry association, we are developing oil tailings management technologies. Working with industry and an Alberta-based SME, we are working to develop a zero-footprint seismic exploration technology. These initiatives will assist in meeting the targets in the areas of reduction in landscape disturbance and accelerated reclamation.

Our corporation continues to focus on a solution-focused approach to **Emerging (and Platform) Technologies**, including advanced manufacturing, data and digital technologies. Several of our investments with post-secondary institutions – which support the generation of knowledge and the application of emerging technologies - enable numerous advancements such as digital oilfield, smart agriculture and health data and technology enabled health services. Alberta Innovates also serves as a systems convenor that brings together partners to collaborate on developing emerging technologies in new and growing sectors through innovation in areas such as virtual and augmented reality, clean technology, advanced materials, robotics, omics technologies, and high-value digital solutions.

PERFORMANCE MANAGEMENT

OUR APPROACH TO PERFORMANCE MANAGEMENT & EVALUATION

As an outcomes-focused organization, we strive to improve the positive results that contribute to a more prosperous economy, cleaner environment and healthier Albertans. At the outset of designing a program or an initiative, we define the overall results we intend to achieve and identify the data needed to measure those results. Measuring our results enables us to demonstrate and communicate the value that R&I investments generate for the province. We also aim to improve "what we do and how we do it" through collective efforts to a common end.

Reflecting international best practices, performance management and evaluation in Alberta Innovates will be guided by an impact framework that helps us track and evaluate our progress. The Research and Innovation Impact Framework (see Figure 7), which is sector-neutral and complementary to ARIF, was co-developed with the Ministry of Economic Development and Trade (EDT).

Figure 7
Research and Innovation Impact Framework Version 1.0[13]

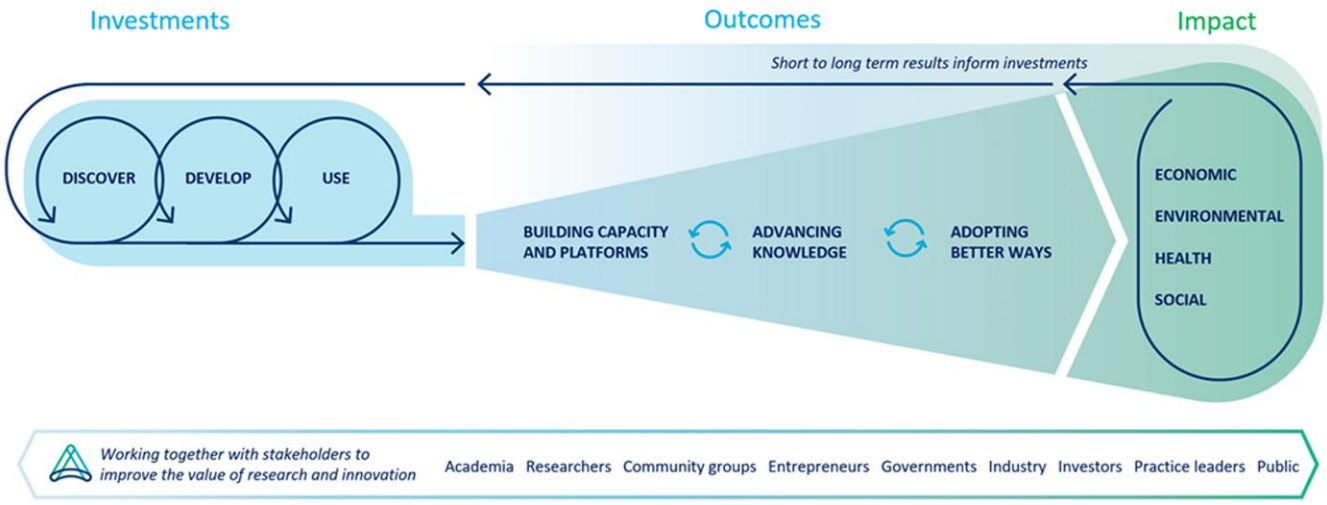


Figure 7 reads from left to right, starting with a venture investment view across the R&I continuum of discover, develop and use (see Appendix A). These supports strengthen the R&I system through three enabling outcomes: Building Capacity and Platforms, Advancing Knowledge and Adopting Better Ways. The "pull" from end users helps inform the adoption of better ways in terms of pathways to new or improved policies, practices, processes, technologies, products and services. New, innovative approaches and technologies can lead to solutions to the province's challenges and, depending on the pathway, result in economic, environmental, health and/or social benefits for Albertans.

[13] Research and Innovation Impact Framework V1.0*, Jan. 07, 2019 (*will be further refined)

These benefits (i.e., impacts) are how we make a difference and represent the "so what" of what we do for Albertans.

Starting in 2019, the framework will be used to monitor and evaluate the extent to which our new strategic plan, investment strategies and operational plans contribute to achieving our goals and intended outcomes. Key performance indicators (KPIs) have been co-identified and are being finalized with EDT to monitor our progress and results. Cascading scorecards/dashboards that reflect these KPIs as well as scheduled evaluations will be used to systematically implement the framework in our organization. This will generate critical evidence for purposes of accountability, transparency to the public and reviewing programs to inform allocation decisions. The evidence will also be used to inform continued alignment, learning and adjustment initiatives to ensure ongoing performance improvement.

The R&I Impact Framework depicts the feedback loops within a complex system. These loops illustrate how R&I investments, outcomes and impacts inform future activities such as strategic planning, investment strategies and policy.

The Research and Innovation Impact Framework and its associated KPIs provides a significant opportunity to bring Alberta Innovates, EDT and our partners "closer" together through a common approach to measuring contributions in a complex, inter-dependent R&I system. We understand we are in a unique position to develop, manage and measure the performance and effectiveness of these relationships. We can now start to work with our stakeholders to identify ways to optimize impacts and create the conditions for learning and performance innovation within the R&I system. An implementation plan is being developed to operationalize the framework.

PLANNED OUTCOMES AND MEASURES

In the tables that follow, each of our corporate goals is accompanied by a goal statement that briefly describes the high-level activities through which it will be accomplished. The tables include the intended outcomes for the goal and associated key performance indicators that will be used to show progress towards the outcomes. Milestones have also been outlined to help guide our incremental progress and key actions.

The performance measures consist of KPIs that were co-developed with EDT as well as those we identified for our corporate balanced scorecard currently under development. The KPIs and the corporate balanced scorecard are being pilot tested during the latter part of 2018-19 and first quarter of 2019-20. The results will assist us in developing effective, corporate-wide data collection and management processes.

Targets will be established for each outcome in the future once a baseline has been established. It is anticipated that the pilot test will provide a starting point for establishing baseline for a portion of the KPIs.

GOAL 1

Make the lives of Albertans better today and for generations to come by contributing to a diversified economy, cleaner and sustainable environment, and healthier communities.

Goal Statement:	**Economy:** Benefits to Alberta's economy resulting from commercialization of a new product or research innovation, creation of a new innovative enterprise or growth of an existing enterprise because of an innovation, cost savings, etc. This also captures follow-on funding, which is additional R&I funding attracted by Alberta-based researchers and innovators. **Environment:** Improvements in Alberta's air, water and land through the implementation of new technologies and strategies to reduce the impact of industry on the environment, improve water management and treatment technologies, and transform waste into useable products. **Health:** Improvements in the health status of Albertans, health system performance including the quality of care delivered, and the determinants of health. **Social:** Enhanced well-being of Albertans, including the improved inclusion of vulnerable populations and overall levels of happiness of the province's citizens.
Intended Outcomes:	• Contribute to improved economic prosperity in Alberta. • Contribute to the mitigation of negative environmental impacts in Alberta. • Contribute to effective resource management in Alberta. • Contribute to the improved health and well-being of Albertans.
Performance Measures:	**Economic Prosperity – Diversification and Job Creation** • Increase in GDP due to technology deployment and innovation • # of new hires (jobs) in Alberta from R&I investment • % of SMEs that remain active up to five years post-funding/support • # of R&I spin-outs still active up to five years post-funding/ support, by sector • % of SMEs with increased revenue • % of SMEs supported by AI that are exporting **Environmental – Environmental Stewardship and Climate Leadership** • # of potential GHG emission reductions from projected deployments • % increase in water use conservation, efficiency, productivity • % reduction in landscape disturbance and % accelerated reclamation **Health – Engaged Individuals and Communities for a Healthy Alberta** • To be determined in collaboration with EDT • Mobilize health data to improve patient care and enable health outcome

	Social – Better Society for Albertans • To be determined in collaboration with EDT • Address inclusion and diversity within funding grant
Milestones:	An impact assessment and management system is developed and includes a schedule for conducting impact assessments and across AI's portfolio of programs and services. The associated case studies will be part of the evidence to demonstrate achievement of impact**.** **Economic Prosperity – Diversification and Job Creation** • All areas of business contribute to economic diversification, more specifically a portfolio of programs is dedicated to commercializing technology as well as advancing companies and projects across the technology readiness levels. **Environmental – Environmental Stewardship and Climate Leadership** • CCITF continues to be executed according to plan, including assessment and measurement of GHG emission reductions. Continue to focus on partnering and leveraging funds both provincially and nationally. **Health – Engaged Individuals and Communities for a Healthy Alberta** • Progress continues on key initiatives such as Secondary Use Data Project and the open innovation institute to ensure increased access to integrated data that improves patient care and enable health outcomes. **Social – Better Society for Albertans** Work has started on how to operationalize diversity and inclusion across the grant life cycle in the CCITF initiative. This initiative can be used as a pilot for scaling this through the organization.

GOAL 2

Cultivate a world-class research and innovation system that meets the needs of Alberta.

Goal Statement:	In collaboration with our partners, enable the development, attraction and retention of a highly qualified and skilled R&I talent pool in priority areas for Alberta. Enhance and accelerate the ability in the province to address our needs of today and tomorrow through improved and integrated R&I capacity - for example, through building physical and virtual R&I infrastructure (e.g., centres, laboratories, technology development and testing facilities, etc.); building innovation platforms (e.g., digital technologies and solutions); improved access to research, skill development and technical expertise; improved system connectivity.
Intended Outcomes:	• Strengthen Alberta's knowledge workforce through R&I. • Develop, attract, retrain the workforce of tomorrow. • Support (re)skilling of highly qualified personnel (HQP) workforce for a knowledge- and technology-based market. • Strengthen Alberta's R&I infrastructure. • Enhance access to R&I innovation/digital platforms. • Enhance community access to technical expertise and system connectivity.
Performance Measures:	• # of people (researchers, entrepreneurs, etc.) supported • Assess market demand and supply of high technology jobs • #/type of new retraining initiatives to support the workforce of tomorrow • # of advanced degrees from R&I investments • # of clients/ accessing R&I infrastructure supported by AI
Milestones	• AI is using a portfolio approach to review its HQP programs. A major project is underway to review HQP programs across the R&I continuum and ensure they are meeting the demands of the system and partners (e.g. post-secondary institutions, etc.). • The organization is developing strategies and actions toward digital platforms, including increasing support and growing the talent in priority areas (e.g., emerging technologies, artificial intelligence, etc.). • Evaluate the Strategic Patient Oriented Research Initiative 1.0 to determine how the platform can be improved to meet client needs and contribute to achievement of patient outcomes. • In collaboration with our partners, propose an impact management system for assessing the success of the technology talent initiative for Alberta. Once approved, develop a scorecard with success metrics, including identifying the (re)training needs of learners and assessing specific skill gaps to fill demand-based jobs in Alberta.

GOAL 3

Drive the generation of discoveries and developments that positively impact Alberta and its industries by leveraging partnerships, collaborations and emerging technology platforms.

Goal Statement:	Help enable researchers and innovators to produce new knowledge, discoveries, developments and breakthroughs. Leverage AI's network of partnerships, collaborations and emerging technology platforms to help share these new advances with the people and organizations that can put them into practical use.
Intended Outcomes:	• Foster cross-sector system linkages to advance knowledge. • Share knowledge and innovations across sectors. • Support clients (e.g. companies, innovators) along their stage of development/readiness. • Translate discoveries and development into innovations through system linkages.
Performance Measures:	• #/% of collaborations and engagements at a local, provincial, national and international level to achieve desired outcomes • Publication citation rates • # of patents produced from R&I investments • AI staff and services assist clients in making progress in their activities to meet their expected result • Development of an Inventory of success stories that demonstrate translation of R&I into innovation through leveraging partnerships and collaborations
Milestones:	• Processes are created that identify and inform investments in emerging technologies in collaboration with EDT, academic and research institutions and other stakeholders. • AI will continue to leverage existing collaborations (e.g. ACAMP, NINT) to increase innovative production and distribution and identify new partnerships for growth. • An internal project is being rolled out across the organization to map the client journey and create consistent levels of service to our partners and clients. • Develop and creation of a repository of impact/success stories demonstrating how partnerships and collaborations contributed to translation of discoveries and developments to innovations.

GOAL 4

Accelerate and broaden the use of innovative products, technologies and processes.

Goal Statement:	New knowledge, discoveries, developments and breakthroughs are used to address the province's needs through new and/or improved policies, processes, technologies and products, practices and services. It is through the adoption of these better ways that investments in R&I make positive changes in the way that Albertans think and do things. It is also the cornerstone to achieving wider impact.
Intended Outcomes:	• AI provides an enabling environment that helps accelerate innovations across the R&I continuum. • Innovations (i.e., new or improved products and services, practices and policies) are produced with the support of AI. • Innovations (i.e., new or improved products and services, practices and policies) are used (i.e., adopted). • The scale-up and spread of R&I from adoption to impact is accelerated.
Performance Measures:	• Average cycle time from grant application to availability of funds to the recipient • % of funding decisions made within target cycle time • # of innovations created with support of AI • Description of companies and interventions that have scaled and spread with the support of AI • Accelerated advancement of companies/projects across the Technology Readiness Levels for technology investments
Milestones:	• Implementation of a single enterprise grants management system that better enables the monitoring of administrative processes (e.g., cycle times) to inform improvement initiatives. • Continue to build on the partnership with AHS on the Partnership for Research and Innovation in the Health System (PRIHS), through a continued launch with PRIHS 5. • In partnership with other stakeholders, submit applications to the Government of Canada's Strategic Innovation Fund in health and agriculture, with the intent of accessing federal funding to address the valley of deaths from discoveries to adoption. • Implement the Board-approved InnoTech Action Plan that focuses on "translation, de-risking and testing" across the R&I continuum. • Publications of impact case studies from external evaluations that demonstrate the scale and spread of R&Is to adoption. • Use the Technology Readiness Levels to inform gaps in services in the R&I system and measure acceleration across the levels for technology relevant programs and projects.

GOAL 5

Be recognized globally as a leading innovation engine.

Goal Statement:	AI brings together representatives from industry, government, academia and the community to deliver 21st solutions for the most compelling challenges facing Albertans. We build on the province's strengths and invest across the R&I continuum.
Intended Outcomes:	• Co-ordinate and align investments across the R&I continuum to achieve our mandate, priorities and goals. • Shifts investments to align with current strategic priority areas. • Engage in or otherwise stimulates cross-sector collaboration and leverages connections with industry, governments, academia and the community. • Albertans have increased awareness and familiarity with AI. • Clients have a positive experience with AI.
Performance Measures:	• $ invested across the R&I continuum • $/% invested in new strategic priority areas • #/% of local, national and international participants attending INVENTURE$ • $ attracted to AI from external sources • % of Albertans aware of AI • % of clients with positive client experience (i.e., satisfaction)
Milestones:	• An investment framework based on performance monitoring and management principles was developed as a guide to inform R&I decision-making, including investment criteria that focus on impact investments. These criteria are being implemented through the CCITF initiative and will be implemented using a "fit for purpose" approach across the organization. • Continue to socialize AI's Five-Year Strategy with internal and external stakeholders as well identify and implement key actions to shift towards those priorities. • The INVENTURE$ conferences for 2019 and 2020 are launched with full turnout and participants/presenters include representation at local, national and international levels. • Develop a master brand strategy to increase our brand and awareness along with an accompanying action plan. • Conduct a client survey that looks at the organization as a whole and includes outcome questions on efficiency of the client journey, effectiveness, and the relevance of AI funds and services to meet needs.

ALBERTA INNOVATES

CONSOLIDATED BUDGET

This consolidated statement of operations reflects the consolidation of Alberta Innovates with its two wholly owned subsidiary corporations C-FER Technologies (1999) Inc. and InnoTech Alberta Inc., along with the Alberta Foundation for Health Research.

Total revenue is expected to decrease from 2018-19 primarily due to the decrease in the Alberta Heritage Foundation for Medical Research Endowment Fund. Grant revenue associated with endowments will be restricted to the predetermined use of those endowments.

The expenses have been expressed in terms of Alberta Innovates business lines:

- **Research, Innovation & Commercialization**: Includes investments in Health, Bio, Clean Energy, Entrepreneurial Investments, Post-Secondary Investments and Strategic Initiatives.
- **Applied Research**: Includes expenses for InnoTech Alberta Inc. and C-FER Technologies (1999) Inc.
- **Administration:** Includes all corporate services such as finance, marketing and communications, information services, facilities, legal, human resources, purchasing, corporate planning and portfolio management, and performance management and evaluation. Administration serves a critical function in the Corporation by providing essential supports to the operational business lines (Research, Innovation & Commercialization and Applied Research). These corporate services enable the operational business lines to work productively and efficiently toward achieving Alberta Innovates strategic priorities and goals. Corporate services play a direct role in advancing Alberta Innovates strategic priority Embrace the Digital Future, given that many of them will be leading and/or actively participating in streamlining and automating our internal processes and operations.

Budgeted expenditures reflect primarily existing contractual obligations. Alberta Innovates received an expenditure reduction in 2019-2020 associated with the decrease in the Alberta Heritage Foundation for Medical Research Endowment Fund.

Budget amounts for 2020-2021 and 2021-2022 are estimates based on existing contractual obligations and average annual spending. Any significant reductions or adjustments reflect the end of existing programs.

Although an accumulated surplus exists, a total expense target has been assigned to Alberta Innovates through the government budget process, which limits total expenses and the use of the surplus.

An annual surplus of $12.6M* is budgeted for 2019-2020, which increases the accumulated surplus to $92.7M*. The accumulated surplus was generated from timing differences on expenditures over the last few years.

*__NOTE:__ Subsequent to the submission of this Business Plan to EDTT on March 31, 2019, the budget received by Alberta Innovates on October 24th, 2019 was a significant reduction compared to what was submitted. This delay and reduction impacted our activities. Please see the APPROVED budget on page 29 for the revised allocations and surplus totals.

ALBERTA INNOVATES

ALBERTA INNOVATES

CONSOLIDATED STATEMENT OF OPERATIONS

(dollars in thousands)

DRAFT

Submitted to EDT March 31, 2019

	2017-18 Actual	2018-19 Budget	**2019-20 Budget**	2020-21 Budget	2021-22 Budget
Revenues					
Government Transfers					
Funding from Economic Development and Trade					
Base Grant	$ 160,849	$ 160,249	**$ 141,999**	$ 141,999	$ 141,999
Restricted Grant from Prior Years	19,742	22,229	**61,125**	41,025	35,025
Other Grants	9,497	54,100	**15,500**	15,500	13,000
Restricted Capital Contribution	344	1,475	**1,540**	1,670	1,820
Funding from Other Government of Alberta Entities - Other Grants	12,957	13,193	**2,209**	1,332	(132)
Federal Government Transfers	2,691	5,369	**4,000**	1,000	1,000
External Revenue and Industry Funding	48,638	50,282	**50,000**	50,000	50,000
Investment Income	1,016	801	**700**	600	500
Other Revenue	557	3,835	**5,723**	5,723	5,723
	256,291	311,533	**282,796**	258,849	248,935
Expenses					
Research, Innovation and Commercialization	184,670	191,016	**168,241**	155,099	152,594
Applied Research	63,614	67,170	**68,481**	68,500	68,500
Administration	29,060	30,030	**33,477**	33,500	33,500
	277,344	288,216	**270,199**	257,099	254,594
Annual Surplus (Deficit)	(21,053)	23,317	**12,597**	1,750	(5,659)
Accumulated Surplus, Beginning of Year	77,823	56,770	**80,087**	92,684	94,434
Accumulated Surplus, End of Year	56,770	80,087	**92,684**	94,434	88,775

ALBERTA INNOVATES

CONSOLIDATED STATEMENT OF OPERATIONS

(dollars in thousands)

APPROVED

	2017-18 Actual	2018-19 Actual	**2019-20 Budget**	2020-21 Budget	2021-22 Budget
Revenues					
Government Transfers					
Funding from Economic Development and Trade					
Base Grant	$ 160,849	$ 160,249	$ 131,168	$ 120,168	$ 120,168
Restricted Grant from Prior Years	19,742	35,590	33,426	17,000	15,000
Other Grants	9,497	20,654	10,756	8,000	6,000
Restricted Capital Contribution	344	1,341	1,540	1,670	1,820
Funding from Other Government of Alberta Entities - Other Grants	12,957	12,354	9,200	5,000	5,000
Federal Government Transfers	2,691	5,245	4,000	1,000	1,000
External Revenue and Industry Funding	48,638	49,191	38,000	28,000	28,000
Investment Income	1,016	2,288	2,000	1,500	1,000
Other Revenue	557	3,192	6,523	3,000	3,000
	256,291	290,104	236,613	185,338	180,988
Expenses					
Research, Innovation and Commercialization	184,670	183,302	117,395	118,201	117,801
Applied Research	63,614	65,930	48,817	46,000	46,000
Administration	29,060	28,913	36,213	27,000	27,000
	277,344	278,145	202,425	191,201	190,801
Annual Surplus (Deficit)	(21,053)	11,959	34,188	(5,863)	(9,813)
Accumulated Surplus, Beginning of Year	77,823	56,770	68,729	102,917	97,054
Accumulated Surplus, End of Year	56,770	68,729	102,917	97,054	87,241

CAPITAL PLAN & LEASING ARRANGEMENTS

Alberta Innovates and its subsidiaries occupy a significant inventory of research and office facilities, most of which are owned and operated by Alberta Infrastructure. In addition to the Government of Alberta facilities, we also occupy space with commercial lease arrangements as shown in the table below. With the consolidation of Phipps McKinnon staff to Mill Woods and Bell Tower, we currently operate across **11 locations**: Edmonton (5), Calgary (3), Devon, Vegreville and Victoria, B.C., with well over 1.2 million square feet of space and 600 acres of research farmland. In addition to our facilities, we also possess a substantial inventory of research equipment with an estimated replacement asset value well over $150 million.

Adequate infrastructure is a vital requirement to support our vision, sustain program effectiveness and manage program growth aligned to corporate and provincial priorities. Over the next three years, an estimate of $51M will be required to implement priority capital projects as shown in the three-year capital plan below.

Working with EDT and Alberta Infrastructure, funding for all major capital projects was secured and the approved funding was transferred to Alberta Infrastructure in 2018-19 to support development and implementation of these projects.

Working with EDT through the Alberta innovation infrastructure planning and management process, we have been receiving an annual capital maintenance and renewal (CMR) grant between $1.295M to $ 2.6M from EDT over the past three years. This supports part of the ongoing innovation equipment maintenance and renewal needs which are critical to operations and not being met through any existing funding sources. In addition, a five-year total of $12M has been earmarked in the 2018-19 Provincial Fiscal Plan for provincial innovation infrastructure CMR projects. Our three-year CMR budget forecast is estimated to remain at $3M annually and this estimate is in reasonable alignment with the industry CMR benchmark.

We will continue to work closely with EDT and strive to expand the provincial innovation infrastructure capital funding source to meet the annual $3M corporate CMR requirement, and to include new equipment investment which is currently an $8.5M, self-funded annual expenditure for the organization. In addition to the Alberta Innovation Infrastructure and Management Plan, an asset management system was implemented at InnoTech Alberta to ensure effective utilization and management of Alberta Innovates assets for priority program.

ALBERTA INNOVATES

2019-22 CAPITAL PLAN FUNDING PRIORITIES

$ In thousands

Projects by Location	Type of Project	Project Scope and Justification	Proposed Timeline	2019-20 Est	2020-21 Target	2021-22 Target	3-Year Total	Funding Sources
Edmonton – InnoTech Alberta								
Alberta – Canada Collaboratory in Cleaner Oil Sands Development Memorandum of Understanding	Major Capital	Devon Strategic Capital Plan (Former AITF) Safety Issues /Concerns – Fuels and Lubricants. Total Project Cost: $4,468K*(only $4 M was approved in 2018 Fiscal Plan)	24 months	$3,200	$600	$0	$3,800	**EDT and GOA**
Govier Air Handling Unit Replacement	Major Capital	Existing system has been posing carbon monoxide and air quality concerns which can only be effectively corrected by replacement Total Projects Cost: $2M*	12 months	$860	$0	$0	$860	**EDT and GOA**
All Sites – InnoTech Alberta								
Fume Hood Replacement Program	Major Capital	Yearly certification testing and recent physical assessment reports indicates the majority of fume hoods are experiencing critical challenges which can only be effectively corrected by replacement. Total Project Cost: $29,685K*	108 months	$4,000	$4,000	$4,000	$12,000	**EDT and GOA**
All Sites – Alberta Innovates, InnoTech Alberta and C-FER								
Program Equipment, Minor Facility Projects and Corporate Systems	Ongoing Capital Renewal and Investment	Miscellaneous corporate systems and equipment identified from annual budgeting process. Annual Capital Renewal Budget: $3.0 M Annual Investment/Self-Funded Capital Budget: $8.5M (unfunded pressure)	2 to 12 months (project dependent)	$11,500	$11,500	$11,500	$34,500	**Alberta Innovates, EDT and GOA**
TOTALS				**$19,560**	**$16,100**	**$15,500**	**$51,160**	

* **Note: Approved funding will be transferred to Alberta Infrastructure for project development and implementation.**

ALBERTA INNOVATES

COMMERCIAL LEASE ARRANGEMENTS

Location	Size	Termination date	Scope of Operations
1. Victoria	5,030 square feet	July 31, 2023	**InnoTech Alberta - Water Characterization Group**
2. Edmonton Pylypow	12,925 square feet	June 30, 2019	**InnoTech Alberta - Instrument Technical Services** **Note: Lease is under negotiation for a possible 5-year extension**
3. C-FER East Pylypow	36,650 square feet	May 31, 2020	**C-FER - Engineering Consulting and Full-Scale Testing for C-FER's Pipelines and Structures**
4. Edmonton Bell Tower	30,840 square feet	Dec. 31, 2020 & Sept. 30, 2022	**Alberta Innovates**
5. Calgary AMEC Place	**5,945 square feet**	**March 31, 2021**	**Alberta Innovates**

ALBERTA INNOVATES

RISK MANAGEMENT

Alberta Innovates is committed to ensuring that risk management practices are embedded in the development of the business and operational plans to drive consistent, effective and accountable action. We actively manage the risks which could adversely impact our ability to deliver on our business plan. The risk management framework designed by AI was informed by and is consistent with the best practices of generally accepted global risk management standard frameworks. Our risk management framework also aligns with that of the Government of Alberta. The following significant risks have been identified by senior management:

1. Impact on desired outcomes from budgetary constraints or declining revenue streams

Budgetary constraints can greatly diminish our ability to fulfill our funding commitments, invest in new opportunities or to sustain critical talent and infrastructure assets required to support the long-term nature of R&I. While pressure remains on our revenue streams, multi-year funding agreements and a significant number of unionized and long-service employees limit our ability to course correct in the short term without jeopardizing desired outcomes.

Potential Impact: Medium-High	**Likelihood of Occurrence:** Medium-High

MITIGATION STRATEGY: Our business plan and budget have been developed prudently, balancing short-term fiscal pressures with the long-term demands and cost commitments for research and development. Additional controls have been put in place to monitor our financial position monthly and we are working closely with the Government of Alberta to address budgetary constraints resulting from changes in fiscal policies. Articulation of our contribution to the Province's desired outcomes through measures such as a system-wide scorecard and success stories will help mitigate reductions in funding. A strong focus on business development and client attraction and retention will be maintained.

2. Cybersecurity

Ensuring the integrity, confidentiality and availability of information is a growing concern for many organizations. Our ability to protect sensitive data could be compromised by cyber threats and this risk could increase as we further embrace digital technologies in our tools and systems. A breach in our cybersecurity represents both operational and reputational risks for which business continuity and disaster recovery planning will play crucial roles.

Potential Impact: Medium-High	**Likelihood of Occurrence:** Medium

MITIGATION STRATEGY: Our five key strategies designed to mitigate potential cyber threats are:

- Prevent: Includes communication with all business units, spam detection, firewall/network protection, file sharing, and security for third-party applications.

- Monitor: Information Technology (IT) professionals are trained to escalate data risk or data breach incidents as they occur, with backups monitored to ensure continuity.
- Detect: IT professionals are trained to ensure that if a cyber event happens, it is escalated to the right people to act quickly.
- Handle: Disaster recovery plans are being revamped. There is new testing within IT to ensure processes can be executed properly.
- Train: Programs to raise awareness about how to identify and combat common forms of cyber-attack have been rolled out to AI staff.

3. Reporting Capacity

The reporting required of our organization has been increasing in volume and complexity over time, without a corresponding increase in resources. This has been further impacted by consolidation as several legacy reporting practices were carried forward, potentially resulting in duplicative work and inconsistent messaging. This has potential to harm our reputation.

Potential Impact: Medium	**Likelihood of Occurrence:** High

MITIGATION STRATEGY: We are reviewing and streamlining our reporting processes, including working with stakeholders such as EDT to better understand what information is required and when. This will inform a consolidated reporting strategy that will effectively communicate our message in a more resource-efficient way. This effort is supported by the development of a corporate balanced scorecard and through joint work with EDT on the Research and Innovation Impact Framework and associated system-wide scorecard.

4. Damage to AI Reputation

It is important that our investments are optimally aligned to our strategic direction and that the benefits of those investments for Albertans are known. Otherwise, we risk damaging our credibility and reputation with our stakeholders, potentially leading to a loss of confidence in our ability to fulfil our mandate. This could result in bad publicity, damage to key stakeholder relationships and, ultimately, a reduction in funding.

Potential Impact: Medium-High	**Likelihood of Occurrence:** Medium-High

MITIGATION STRATEGY: Rolling program reviews are being conducted on a regular basis to confirm that our investments align with our strategic priorities. We also maintain communication with stakeholders to ensure that we are meeting the needs of the province. We will communicate our value to the R&I system through our Annual Report, success stories, stakeholder engagement and the system-wide scorecard.

5. Talent Capacity

We require the correct balance of human capital to achieve our strategic priorities and goals. Our focus on emerging technologies and digitization of our tools and systems depends on our ability to retain and attract employees with specialized skills and retrain existing employees. We compete with industry and government for highly skilled workers from a limited pool of potential candidates.

Potential Impact: Low-Medium	**Likelihood of Occurrence:** Medium

MITIGATION STRATEGY: We regularly review the current skills and experience within the organization to ensure we are adequately staffed to achieve success. Ongoing integration management will inform the potential reallocation of staff to underserved areas in the Corporation and we continue to focus on succession planning to mitigate the risk of loss of personnel in key roles. Recruitment strategies are being driven by future talent needs as informed by the strategic plan. A formal process to monitor employee engagement is in place to help identify employee concerns, reduce staff turnover and minimize the loss of expertise in the business.

APPENDIX A:
Research and Innovation Continuum

DISCOVER aims to create new knowledge or understanding that does not have specific applications in mind from the outset. This type of research is usually performed at universities. It includes basic and applied research.

DEVELOP involves developing knowledge from the discovery stage toward a particular use. This applied research or development work typically occurs in applied research areas within universities, colleges and polytechnics as well as industrial research laboratories and company laboratories.

USE is about translating and applying developed research to address needs in the "real world." This innovation activity focuses on processes for the uptake, spread and scale of application-ready research. Examples include technology adaptation, technology commercialization, product and market innovation, and translational research in health care.

APPENDIX B:
Our Business Lines

Our highly specialized business lines are the engines that will drive implementation of our five-year strategy and our progress toward achieving our corporate goals. The business lines provide clients with a combination of deep knowledge, expert perspectives, and real-time insights to address issues of strategic importance in the province. In the year ahead, our business lines will continue to develop and operationalize programs with defined outcomes that solidly align to our corporate priorities and goals. Legacy programs that continue to be operated will do so with a view to improving their contributions to our current direction. In all cases, increasing cross-sectoral integration will be a primary focus of the business lines and the programs they provide.

Following is a summary of each business line's plan, their key actions and alignment to the corporate goals. The plans provide insight into the primary client groups they serve their focus areas and activities for 2019-22. Our organizational model has been altered with the creation of a new business line called Emerging Technologies, to reflect our strategic shift in this direction.

Our five corporate goals guide us in shaping this business plan and our internal operating plans. These goals are to:

- *Make the lives of Albertans better today and for generations to come by contributing to a diversified economy, cleaner and sustainable environment, and healthier communities.*
- *Cultivate a world-class research and innovation system that meets the current and future needs of Alberta.*
- *Drive the generation of discoveries and developments that positively impact Alberta and its industries by leveraging partnerships, collaborations and emerging technology platforms.*
- *Accelerate and broaden the use of innovative products, technologies and processes to benefit Albertans.*
- *Be recognized globally as a leading innovation engine.*

Note: Each program can reasonably contribute to more than one corporate goal given that programs typically have multiple objectives.

RESEARCH, INNOVATION AND COMMERCIALIZATION

Bio

The **Bio** business line contributes to the government's R&I priorities by providing leadership and co-ordination for activities that support the growth and diversification of Alberta's agriculture, forestry and food sectors. We are shifting our activities to focus more on emerging technology areas, in alignment with our organization's strategic direction.

Many of the bioindustrial development projects will be data-intensive including:

- Biomass availability determination through Alberta's Bio-Resource Information Management System
- Data enhanced building fabrication and testing through the Modular and Offsite Construction Network
- GHG efficiency estimation through real time data capture and use in modeling.

There is a strong emphasis on clean technology and innovative products and distribution including those focused on cellulose nanocrystals (CNC), lignin and hemp.

The nature of the work around environmental markets is focused on geospatial data, platforms and emerging technologies. Geospatial data information exchange standards and protocols, and analytics including indicator visualization and forecasting algorithms will be supported to advance Ecosystem Services (ES) adoption and decision-making geomatics. Applications will utilize machine learning to support predictive ES mapping products that can be used by the agriculture, forestry and energy sectors to develop integrated strategies for cost-effective management of collective ecological results. Cloud based "smart" platforms will transform how businesses consider, manage, track, and report on ES impacts and investments through their supply chain.

Bio will support development of automation and new digital technologies to improve efficiency and reduce risk associated with decision-making on farms and in food manufacturing. This includes development of a network of Alberta "Smart Farms" to accelerate industry adoption. This network will utilize a blockchain approach to building consumer trust in the agri-food sector. **Bio** will invest in generation of new knowledge, products, processes and services that will increase revenue from value-added processing.

A significant portion of the funds committed to projects **Bio** invests in are and will continue to be dedicated to enhancing Alberta's knowledge workforce, i.e., M.Sc. and PhD researchers and post-doctoral fellows, through work on specific projects with defined outcomes that support industry growth. This includes the Alberta Prion Research Institute (APRI), which supports fundamental and applied research projects that take an interdisciplinary approach to solving the mysteries of prion and protein misfolding.

New programming will target "Smart Agriculture and Food" through data-enabled innovation, data for business transformation or innovative production processes as a means of accelerating productivity, profitability and global competitiveness.

Bioindustrial programs will more fully incorporate digital data acquisition, digital technology, clean technology and innovative products into new requests for project proposals that can positively impact Alberta industry.

Key Actions	Description	Corporate Goals				
		1	2	3	4	5
New products and technologies from biomass resources; lignin, hemp and purpose-grown trees.	Through RFP's will solicit new ideas and opportunities for products and technologies that add-value to biomass. We will work with the West Fraser lignin facility in Hinton for lignin innovation; with hemp growers and processors in AB for fibre innovation and to optimize purpose-grown trees for bioenergy and mine reclamation utilization; we will work with collaborators ERA, NRCan, EPCOR, Capital Power and City of Edmonton.	X	X	X	X	X
CNC Challenge	Through RFPs solicit research proposals for new opportunities to develop applications for CNC and increase market demand for CNC	X	X	X	X	X
Bio-based knowledgeable workforce development	Will support capacity building through NSERC IRC's, Centres of Excellence, and researchers in areas of clean technology and green building; will connect post-graduates to emerging business needs related to Ecosystem Services, leading to an enhanced workforce.	X	X	X		X
Ecosystem services and biodiversity market advancement	Working with a consortium of collaborators in the Ecosystem Services and Biodiversity Network, this initiative is designed to create the system to support an environmental market system in Alberta. Projects include leadership training module development, development of a property rights report, stakeholder engagement and pilots/case studies.	X	X		X	X
Data-driven agriculture	Invest in projects that focus on developing new digital technology or use data enabled technology to improve agriculture productivity and sustainability; facilitate development of a value chain blockchain construct that addresses market specific consumer demands for agricultural product traceability and safety; support development of the Olds College Smart Farm as a prototype for learning about, developing, demonstrating and validating new smart farm technologies.	X	X	X	X	X
Food manufacturing innovation	Through targeted calls for proposals, AI will stimulate innovation in food product development by food manufacturing businesses and researchers; will explore food manufacturing technology innovations, gaps and barriers to adoption through industry workshops, scanning and industry research.	X	X	X	X	

Deliver on the mandate of the Alberta Prion Research Institute	Invest in relevant basic and applied research in prion and prion-like diseases in animals and humans, such as Alzheimer's disease and other human dementias, and in training of young researchers.	X	X	X	X	X
Prion conferences and workshops	Host conferences and workshops with industry, policy makers, and researchers to identify needs and trends in prion science and the economy. These workshops will deal with emerging technologies in the area of dementias, and the management and control of a significant lethal disease that is spreading in Alberta cervids.	X	X	X	X	X

Clean Energy

The **Clean Energy** business line develops and invests in applied R&I programs to sustain, grow and diversify the energy and resource industries, develop clean technology, reduce greenhouse gas emissions, and protect the environment in Alberta. We support resource and technology companies, small and medium enterprises, and post-secondary institutions in their research, technology development and commercialization. We help industry clients accelerate technology development and deployment, grow their businesses, and enhance competitiveness. Market pull is assured through direct end-user support of all invested projects. We provide technical insights to the Government of Alberta (GOA) on resource development, energy diversification, climate leadership, and water/land policies. The **Clean Energy** team also provides technical due diligence and project management services to Emissions Reduction Alberta (ERA) and co-leads the delivery of Climate Change Innovation and Technology Framework (CCITF) programs.

Clean Energy invests in seven programs across three portfolios:

- Advanced Hydrocarbons portfolio: Includes Cleaner Hydrocarbon Production (CHP) and Innovative Hydrocarbon Products (IHP). Both programs are designed to enhance the economic competitiveness and add value to Alberta's hydrocarbons, and to make Alberta's $100-billion oil and gas industry economic and GHG-competitive. CHP focuses on innovative hydrocarbon recovery, methane emissions reduction, and digital oilfield technologies. IHP focuses on bitumen partial upgrading, natural gas value-add, and Bitumen Beyond Combustion (BBC).
- Clean Technology portfolio: Includes Renewable and Alternate Energy (RAE), Bio-Energy, and Carbon Capture and Utilization (CCU). The RAE supports Alberta's transition to a low-carbon economy by investing in smart grid, energy storage, and low-carbon electricity. The Bio-Energy program focuses on waste to value-added products. The CCU program prioritizes innovation to low-cost carbon capture technologies and converting CO2 into useful products.
- Environmental Innovation portfolio: Includes Water Innovation Program (WIP) and Land and Biodiversity (L+BD) program. WIP is designed to achieve the goals of the Alberta's Water for Life Strategy, and focuses water supply and watershed management, healthy aquatic ecosystems, water use conservation, efficiency and productivity, and water quality protection. The L+BD program focuses on environmental monitoring, oil sands tailings, remediation and restoration, climate adaptation and a new initiative in Abandoned Well Reclamation.

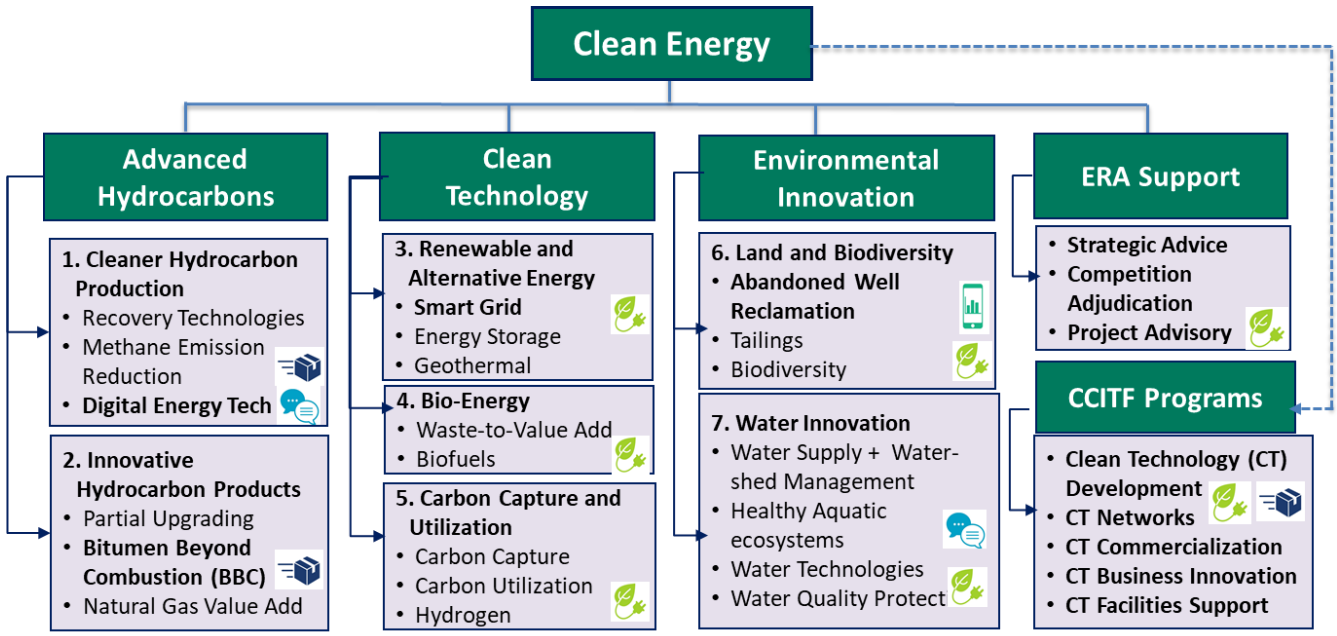
These programs are designed to deliver the R&I outcomes in ARIF including economic diversification and job creation, environmental stewardship and climate leadership, effective resource management and engaged individuals and communities for a healthy Alberta. Recently, new initiatives (highlighted in Figure 8 below) have been developed to focus on the four core emerging technologies AI has chosen: data-enabled innovation, digital technology for business, cleantech, and innovative production and distribution.

In addition, Clean Energy also lead Clean Technology Development (CTD) and Clean Technology Facilities Support (CTFS) Programs in CCITF. CTD facilitates and supports the development of novel clean technologies from bench scale to field pilots, and CTFS helps create new facilities or enhance the existing facilities to fill technical capacity gaps in Alberta's clean technology sectors. Both programs are designed to achieve CCITF's goals in GHG emission reduction, economic growth and diversification.

Clean Energy programs will accelerate and broaden the adoption of innovation in the energy industry, contribute $100 billion in economic opportunities, and lead to greater sustainability in Alberta. Challenges in market access for Alberta's energy products have impaired industry and government's ability to invest in innovation. These issues may affect Clean Energy's progress toward achieving Alberta Innovates' strategic priorities and corporate goals.

FIGURE 8

Clean Energy Business Line Key Actions (note: legend to be added)



Key Actions	Description	Corporate Goals				
		1	2	3	4	5
Programs						
Cleaner Hydrocarbon Production	The CHP program is designed to enhance the economic and GHG competitiveness of Alberta's $100B oil and gas industry. It consists of 3 sub-programs: **Recovery Technologies** funds innovative techniques of hydrocarbon extraction that reduce GHGs, water usage and land footprint while improving the cost competitiveness of industry and/or accessing new resource. **Methane Emissions Reduction** measures, monitors, and mitigates methane emissions in alignment with provincial and federal targets. **Digital Oilfield** accelerates development and adoption of a wide variety of emerging technologies in the oil & gas industry for economic and environmental benefits.	X	X	X	X	X
Innovative Hydrocarbon Products	The IHP program is designed to diversify Alberta's economy and add value to hydrocarbon resources that will enable Alberta to achieve prosperity in a low carbon global economy. It consists of 3 sub-programs: **Partial Upgrading** adds value to Alberta's bitumen while increasing pipeline capacity and reducing industry operating costs and lifecycle Greenhouse Gases. **Methane Value-Add** converts natural gas into higher value products such as liquid fuels and hydrogen. **Bitumen Beyond Combustion** converts bitumen into high-value non-fuel products for economic diversification, value-add, and significant GHG reductions.	X	X	X	X	X
Renewable and Alternate Energy	The Renewable and Alternative Energy Program supports Alberta's transition to a low-carbon economy by investing in a shift to renewable and low-carbon electricity while maintaining a reliable and affordable grid system. It includes three sub-programs: **Grid Modernization** includes the *Alberta Smart Grid Consortium* initiatives and energy storage opportunities. **Low Carbon Electricity** focuses on innovative clean technologies to support the transition to and use of renewables in Alberta. **Low-Emitting Alternative Generation** focuses on new types of generation and decentralized opportunities to diversify Alberta's electricity system.	X	X	X	X	X
Bio-Energy	The Bio-Energy Program supports the development of a bioenergy industry that contributes to Alberta's supply of renewable energy through the production of biofuels and novel value-added products. The program is a key part of the transition to a low carbon future and circular economy and enables the participation of Alberta's urban and rural communities. This sector is served by the programming in Clean Energy as well as	X	X	X	X	X

	Alberta Innovates' Bio division. In Clean Energy, the focus remains on energy conversion and use. The program includes two subprograms: **Waste to Value-Added Products,** and **Conversion and Refining**.					
Carbon Capture & Utilization	The Carbon Capture and Utilization Program invests in transformative carbon dioxide (CO_2) utilization technologies that will contribute to Alberta's greenhouse gas (GHG) mitigation and economic diversification efforts, through bold and focused innovation. The program prioritizes innovation to convert CO_2 into useful products with significant commercial value and market demand through cost-competitive and environmentally sound technology solutions. It includes three subprograms: **Carbon Capture, Carbon Utilization** and **Hydrogen.**	X	X	X	X	X
Land and Biodiversity	The goal of the Land and Biodiversity program is to ensure natural resource development operations and practices are environmentally sustainable. The program is positioned to support achievement of both AI Goals and ARIF Targets for 2030: a) that the rate of land reclamation is equal to or better than the rate of land disturbance, and b) that biodiversity in the province is maintained or enhanced. The portfolio includes subprograms related to **Environmental Monitoring**, **Oil Sands Tailings**, **Remediation and Restoration**, **Climate Adaptation and the new initiative in Abandoned Well Reclamation**. The program is provincial in scope but focuses on oil sands region.	X	X	X	X	X
Water Innovation	The Water Innovation Program (WIP) is designed to achieve the goals of the Alberta's Water for Life Strategy. The program invests in four key themes: 1) **Future Water Supply and Watershed Management**, 2) **Healthy Aquatic Ecosystems**, 3) **Water Use Conservation, Efficiency, and Productivity**, and 4) **Water Quality Protection**. The knowledge and technologies developed in this program will help to create a cleantech industry in water treatment, support 30% improvement in water use conservation, efficiency, and productivity by 2030, and provide safe, secure, and reliable water resources for up to six million people while maintaining the health of aquatic ecosystems. The program has high impacts in agriculture and energy industries and urban and rural communities.	X	X	X	X	X
New Initiatives						
Bitumen Beyond Combustion (BBC)	Clean Energy is the recognized leader of the BBC initiative, completing two whitepapers in 2017/18 and launching 7 projects through a 2018 Open Call in collaboration with industry and post-secondary institutions. BBC has identified target areas in carbon fibre, advanced carbon materials, asphalt, vanadium flow batteries, and biodegradable polymers. The BBC sub-program bears significant potential to benefit Alberta in GHG emissions reduction, employment, economic diversification, and value	X	X	X	X	X

	add. While the funded R&D projects are just launching in Jan 2019, the program has already received substantial media attention from The Economist, Calgary Herald, Edmonton Journal, and CBC.					
Alberta Smart Grid Consortium	Alberta Innovates led the creation of the Alberta Smart Grid Consortium. The Consortium consists of Alberta Innovates, Alberta Energy and the Alberta Distribution Facility Owners (DFOs), consisting of ATCO, ENMAX, EPCOR, FortisAlberta, Alberta Federation of Rural Electrification Associations (AFREA), EQUS, and the Cities of Lethbridge, Medicine Hat and Red Deer. Together, the members work collaboratively on projects to accelerate the development and deployment of smart grid initiatives in Alberta. In 2018, the Consortium invested in 4 projects, with total AI funding of $3.2M and a leveraged total of $57M. Consortium members have also submitted proposals to CCITF competitions and ERA's BEST Challenge.	X	X	X	X	X
Digital Energy) Technologies (DET)	Clean Energy has been actively developing a DET initiative. Digital technologies have significant potential to improve efficiency and competitiveness of the oil & gas industry, as well as emerging Cleantech and other energy-related sectors. Four projects are currently in the review process in the DET initiative; and a broader Clean Energy Digital Open Call is planned for 2019 in collaboration with the Alberta Data Institute. Clean Energy staff have presented at multiple forums and continues to play a prominent role in new consortia in this space, including Clean Resource Innovation Network (CRIN), Petroleum Technology Alliance Canada (PTAC), and Canadian Oil Sands Innovation Alliance (COSIA).					
Abandoned Well Reclamation Initiative	Clean Energy has been working with InnoTech, the Orphan Well Association, the University of Alberta and key government stakeholders (provincial and federal) to develop a new initiative focused on innovative solutions for effective remediation of legacy oil and gas sites in Alberta. The potential liability costs associated with abandoned energy infrastructure, is a priority issue for Alberta Environment and Parks and Alberta Energy, as has been highlighted in several recent public reports and media articles. Innovative, cost-effective solutions to accelerate remediation will be sought to reduce Alberta's and the industry's exposure to environmental liability, while creating local job opportunities and generating clean technology and expertise which can be applied in global markets.	X	X	X	X	X

Emerging Technologies

Alberta Innovates has a series of ongoing emerging technology initiatives and is actively collaborating with stakeholders to develop new ones. The newly created **Emerging Technologies** business line will act as a champion to co-ordinate and develop emerging technology activities across our Corporation, to ensure application in multiple

sectors. We will provide expertise in the four emerging areas that were identified in the Alberta Innovates strategic plan, to augment the sector expertise that exists in our other business lines.

The **Emerging Technologies** business line will operate across our Integrated Service Provider Framework (see page 7 for more information about the framework). Although our primary clients are sector-specific, the new business line will be sector-agnostic in supporting, facilitating and enabling clients' ability to operationalize emerging technology solutions, and in identifying potential cross-sectoral or platform technologies to drive application.

Emerging Technologies will work alongside our other business lines to act as a system convenor by supporting, facilitating and enabling solutions that address the complex needs of AI's clients and Alberta's R&I landscape – whether it is the acquisition of new knowledge, attracting and developing expertise and a qualified workforce in the province, developing new technologies and businesses, or bringing those technologies to industry to help maintain growth and sustainability. We can play a key role in enhancing the knowledge workforce by collaborating with government, post-secondary partners and others to operationalize emerging tech solutions.
Bridging the gap between publicly funded R&I (push) and market-driven demand (pull) represents a strategic opportunity that can enable Alberta to become more effective at translating billions of taxpayer dollars invested in discovery of promising new technologies into successful market outcomes and impacts**. Emerging Technologies** will facilitate the growth and development of emerging technologies in in Alberta that have demonstrated momentum for high potential return and lower risk in AI's four core areas:

- Digital technology for business transformation in areas such as health-care delivery;
- Data-enabled innovation through machine intelligence combined with advanced analytics;
- Leveraging concentrations of local engineering talent to scale/accelerate cleantech innovations; and
- Building advanced manufacturing capacity through innovations in production and distribution.

The aim will be to improve productivity, competitiveness and growth, while developing and employing highly qualified people and enabling ongoing innovative advances in Alberta.

Key Actions	Description	Corporate Goals				
		1	2	3	4	5
Development of emerging technology capacity	Provide leadership to the Emerging Technologies Business Line and transition, socialize, and partner with Business Lines to enable emerging technologies solutions	X	X	X	X	X
Providing digital technology for business transformation consultation services across the organization and to	Enabling and assisting business lines to explore, demonstrate and operationalize digital and/or emerging technology solutions identified by business lines**, with the potential for cross-platform/sector agnostic application.**		X	X	X	X

external clients, partners and other stakeholders						
Provide emerging technology expertise and consultation to the BIO Business Line on key initiatives.	Data-driven agriculture - target projects that develop digital technology or use data enabled technology to improve agriculture productivity. Alberta Smart Farm Network - adoption of automation, digital technologies, data enabled innovations, etc. by Alberta agricultural producers. New Horizons Program - innovative production and the exploration of the use of digital approaches to their prion-related research.	X	X	X	X	X
Provide emerging technology expertise and consultation to Clean Energy Business Line on key initiatives.	Digital Oilfield - accelerates development and adoption of a wide variety of emerging technologies in the oil & gas industry for economic and environmental benefits. Renewable and Alternate Energy – including three subprograms – Grid Modernization, Low Carbon Electricity, and Low-Emitting Alternative Generation. Digital Energy Technologies (DET) - Digital technologies have significant potential to improve efficiency and competitiveness of the oil & gas industry.	X	X	X	X	X
Provide emerging technology expertise and consultation to Health Innovation Business Line on key initiatives.	Data-enabled innovation – launching and operating the Alberta Data Institute, using data to identify opportunities and develop solutions for using artificial intelligence and machine learning tools. Digital Technology for Business Transformation - supporting digital technology development and implementation to support the digital health space.	X	X	X	X	X

Entrepreneurial Investments

The inter-related suite of technology commercialization programs operated by **Entrepreneurial Investments** (see Figure 9 below) is helping establish Alberta Innovates as a leading innovation engine in Canada. We are contributing to AI's goals and helping meet the current and future needs of Albertans by driving partnerships and collaborations that broaden market access and success for the province's technology and knowledge-based entrepreneurs and SMEs.

The **Entrepreneurial Investments** business line assists individual entrepreneurs and high-growth, high-potential SMEs to reduce the time it takes to commercialize novel technology and knowledge-based products, and to scale

their business. We do this through our interconnected, client-facing programs and services that provide coaching, community and capital.

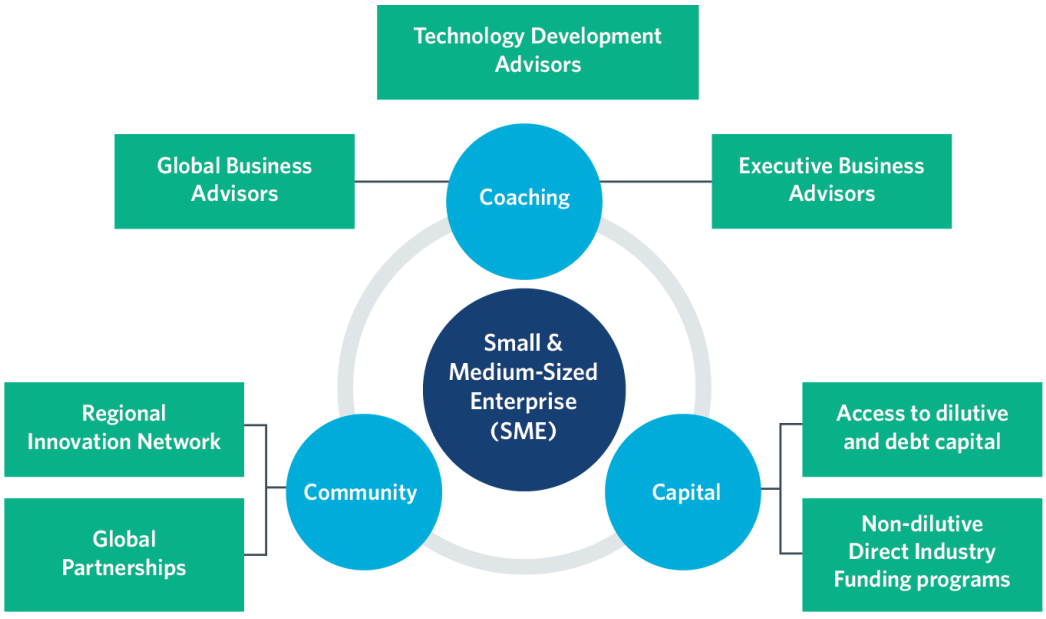
We provide coaching and connections via our Technology Development Advisors (TDAs) and Executive Business Advisors (EBAs). Our **coaching** services provide entrepreneurs and SMEs with advice about best practices for developing, marketing and selling their product and growing their business. We also assist clients in advancing their products by connecting them to technical and scientific centres, engineers, industry groups and others in the broader innovation system. EBAs work with a curated group of companies with commercially validated technology products, to facilitate investor readiness and access to dilutive and debt capital that will support the growth and expansion of their technology business.

As well, we play a valuable role in the innovation system by supporting Regional Innovation Networks (RINs), which stimulate the innovation **community** to improve the sharing of diverse ideas, know-how, expertise and resources needed to produce new technologies, solutions and services. RINs support early-stage entrepreneurs and SMEs through various activities to bring products to market and to use innovation as a growth strategy in ways that are appropriate for each community. Through our support, RINs are evolving to include globally accepted innovation system best practices and leading concepts that will better enable Alberta's innovation system to adapt, grow and strengthen. Community also promotes sustained innovation through novel ways of merging old and new discoveries and ideas.

Capital refers to the investments we make in high-potential, high-growth technology and knowledge-based product innovations. We also help to de-risk and accelerate promising technology to commercialization by investing in small business through our Direct Industry Funding Programs.

FIGURE 9

Entrepreneurial Investments – Interconnected Suite of Programs and Services



We support Alberta SMEs to grow globally by developing partnerships and access to new distribution channels with a suite of co-funded inter-jurisdictional programs. These programs assist in establishing collaborative and mutually beneficial technology partnerships between SMEs in Alberta and a partner region with matchmaking and funding to support strategic, industry-driven commercialization projects for novel and innovative products and materials.

Coaching, community and capital work together as a system. Through this system, the innovation community is working together to bring Alberta R&I to the next stage in its evolution, increase the speed of development and the interactions between the players, accelerate the pace by which technology products get to market, and increase the number of successful SMEs that contribute to our economy.

Entrepreneurial Investments manages three CCITF programs – Clean Technology Networks, Clean Technology Commercialization and the Clean Tech Business Innovation Voucher. These focus on cleaner oil and gas, methane emission reductions, low-carbon electricity, waste to value-added, green buildings and energy efficiency.

Over the next year, we will be focusing on the "validate and scale" portion of the client journey. Our goal is to work with more established SMEs to support their efforts to use emerging technology innovation as a growth strategy.

Key Actions	Description	Corporate Goals				
		1	2	3	4	5
RIN	Regional Innovation Network - RINs support innovation in their community via events, networking, training, incubators, accelerators among other activities while working closely with entrepreneur communities to identify needs, trends and gaps.	X	X	X	X	X
TDA	Technology Development Advisors – proactive coaches and connectors who support the RIN, and high potential, high growth SMEs	X	X	X	X	X
Direct Industry Investment suite of five programs	A suite of direct industry investment programs that together, span the entrepreneurial journey to accelerate technology commercialization and adoption.	X	X	X	X	X
Capital Access/ Major Transactions (CA/MT)	Capital Access/Major Transactions uses the services of Executive Business Advisors to support companies with commercially validated technology products become investment ready and where appropriate, assist with their financing.	X	X	X	X	X

ASBIRI	Alberta Small Business Innovation and Research Initiative is a partnership program that identifies industry challenges and co-funds competition-based SME solutions to industry challenges.	X	X	X	X	X
Global Partnerships	Global Partnerships helps clients learn about how to expand their markets, and co-funds research and innovative product development via strategic partnerships in Mexico and China.	X	X	X	X	X
CCITF: CT Networks	Clean Technology Networks is a program to inspire and evolve Alberta's support systems by providing strategic funds to entities that can provide networks, partnerships or collaboration.	X	X	X		X
CCITF: CT Commercialization	Clean Technology Commercialization is a demand-pull program designed to solve industry operational challenges that would result in quantifiable reductions of greenhouse gases and a leading competitive edge in the global marketplace. Alberta Innovates and our Industry Partners jointly invite Alberta's Small Medium Enterprises (SMEs) to leverage their ingenuity and compete for the opportunity to develop a technology-based greenhouse gas reduction solution for the well-defined operational challenge.	X	X	X	X	X
CCITF: CT Business Innovation Voucher	Clean Tech Business Innovation Voucher is a program designed to encourage and support Alberta's established Small and Medium Enterprises (SMEs) to identify productivity and growth opportunities through business audits and plans and de-risking investment for low carbon technology adoption for industrial efficiency, and/or productivity enhancement; and/or product or service iterations and/or new geographical or market entry.	X	X		X	X
Connectica.ca	We have worked with our RIN partners to identify how best to use the Connectica.ca website in the past year and a half. We will complete interim changes and expect to complete a review of internal and external system map and information needs in 2019 and deliver a new site in 2019-20.		X			X

Health Innovation

Our **Health Innovation** business line delivers a robust R&I portfolio that engages clients throughout their journey and provides supports and services across the innovation spectrum with the aim of building a strong and resilient R&I health ecosystem for a healthy population. Target clients include innovative researchers, health professionals,

entrepreneurs in the health space, Alberta-based SMEs, large MNE health industry players, and the Government of Alberta at large. In partnership with the broader system, our team delivers valuable funding and services to support our clients in achieving economic and health outcomes for the province of Alberta.

The **Health Innovation** business line will continue to implement a shift towards supporting a digital future by deploying additional resources and retooling existing mechanisms to support digital health enablement. This includes the development of B2B partnerships that can support digital innovation and a renewed focus on value-extraction from opportunities in primary and community care, computational biology and bioinformatics, 'omics' and in silico modeling. We will also be implementing mechanisms for talent development that can support and will be supported by the digital future (e.g., digital literacy, analytics, augmented reality training for professionals).

We will be focusing on data as an innovation enabler by launching and operating the Alberta Data Institute, a platform that will provide services and a framework to support and facilitate innovation in data driven and artificial intelligence applications. Another focus is increasing the access to administrative health data and analytical services through the Alberta SPOR SUPPORT Unit (AbSPORU).

Health Innovation will be supporting digital technology development and implementation by designing new programs and retooling existing ones (e.g., AICE) that will provide support for entrepreneurial activity in the digital health space. We will also develop digital solutions that enable our clients to better interact with our team.

Innovation in health-care production and distribution will be achieved by partnering with health systems to enable innovation testing and adoption (i.e., technology, health delivery models). **Health Innovation** will also be launching and engaging in initiatives that will empower patients, providers and communities to better achieve health outcomes using technologies such as virtual and augmented reality, digital technologies that enable self-management of care and the Internet of Medical Things (IoMT).

In support of a digital future, we will be identifying and supporting emerging health industries such as precision health, emerging medical products (i.e., cannabinoids) and virtual health-care management. Since a digital future relies on having useful, trustworthy quality data, the Alberta Clinical Research Consortium (ACRC) is developing guidelines and best practice recommendations to assist researchers in implementing data quality from the start in data design, entry and management.

In propelling great ideas forward, faster and accelerating the success of R&I, Health Innovation provides an integrated suite of services, infrastructure and contributes to building a talented workforce that supports the discovery, commercialization and application of knowledge pathways to impact. Working with the partner organizations, services and training opportunities are available to the R&I communities including assisting with patient/public engagement, knowledge translation, development of novel methodology, incorporating ethical considerations, and developing standardized tools and templates that supports quality research and data. Additionally, Health Innovation is reducing the barriers to clinical health research through streamlining processes across organizations and identifying metrics to support informed decision-making.

Key Actions	Description	Corporate Goals				
		1	2	3	4	5
System & talent development	Deploying additional resources and retooling existing mechanisms to support system enablement projects. This will include (i) the development of new B2B partnerships that can support digital innovation, (ii) a renewed focus on value-extraction from significant past investments (i.e., primary care, computational biology and bioinformatics, 'omics', in silico modelling), and (iii) implementing mechanisms for talent development that can support and will be supported by the digital future (i.e., analytics, augmented reality training for professionals).	X	X	X		
Enabling platforms	Enabling Platforms are inter-related programs (Alberta Clinical Research Consortium, Health Research Ethics Board of Alberta, Ethics Initiatives, Alberta SPOR SUPPORT Unit) with the common goal of providing access, services and resources that facilitate patient-oriented, clinical health research. The programs address gaps, which are often barriers for research to occur. Clinical health research studies generate the evidence for health outcomes. The ACRC is cultivating the clinical health research system through streamlining administrative processes and enhancing the quality, thereby reducing the barriers and increasing the attractiveness to sponsors and investment in Alberta. The program also equips and attract highly skilled workforce and prepares researchers both academic and in community settings for the future trends in clinical health research. HREBA is one of three Health Information Act (HIA) research ethics boards in Alberta and fills the gap of ethics review in cancer and cancer-related, and community-based studies. It is a participant in the provincial efforts to harmonize the HIA designated research ethics boards. Ethics Initiatives is closely tied to HREBA program and has two main efforts: assist groups and organizations in incorporating the ethical issues in projects that do not require research ethics review through the ARECCI program, and is a think tank that considers the potential ethical issues associated with new and emerging technologies and information generated through data analytics. AbSPORU is a joint CIHR/Alberta Innovates funded program with the aim of increasing the quantity and quality of patient-oriented research. In engaging patients as partners, focusing on patient-identified priorities and improving patient outcomes, patients have a say in research that impacts and improves their health outcomes. Once a barrier, AbSPORU has both increased access to data and decreased time to obtain the data. The program also guides researchers with end-user engagement which supports acceleration and adoption of research findings in Alberta.		X	X	X	

Data-enabled innovation	Focusing on data as an enabler by (i) launching and operating the Alberta Data Institute, a community platform that will provide the framework needed for the "open data" concept to become a reality in Alberta, and (ii) using data to identify opportunities and develop solutions for chronic health conditions (artificial intelligence and machine learning tools).		X	X	X	X
Digital technology for business transformation	Supporting digital technology development and implementation by (i) designing new and retooling existing (i.e., AICE) programs that will support entrepreneurial activity in the digital health space, and (ii) developing digital solutions that will enable our clients to better interact with our team.			X	X	X
Innovative health-care production and distribution	Innovating with regards to healthcare production and distribution by (i) partnering with health systems to enable innovation testing and adoption (i.e., technology, health delivery models, PRIHS), (ii) launching and engaging in initiatives that will empower patients, providers, and communities to better achieve health outcomes (IoMT, VR/AR).	X		X	X	
Emerging health industries	Identifying and supporting emerging health industries such as (i) alternative medical products (i.e., cannabinoids), (ii) virtual healthcare management (iii) precision-health.	X				X

Post-Secondary Investments

Alberta Innovates' **Post-Secondary Investments (PSI)** team oversees the sustained delivery of value to Alberta through investment in Alberta's post-secondary institutions to strategically develop capacity in people, key infrastructure, collaborations and projects necessary to create innovative solutions within emerging technology areas of Alberta's knowledge-based economy. The primary clients for this business line are post-secondary institutions and the individuals and groups that comprise them, including researchers, students, post-doctoral fellows and entrepreneurial academics. We serve this client group through a series of programs that strive to cover the R&I continuum by supporting capacity building, capacity utilization and academic company creation and commercialization in emerging technology areas.

In many ways, the suite of programs we operate covers the spectrum of push, pull and bridging. Traditionally, research funding primarily supported discovery and technology development for the sake of advancement of knowledge alone. Presently, however, our programs also support bridging the gap between academia and demand for technological solutions from small and large industries.

The **PSI** business line aligns nearly all its activities and programs to Alberta Innovates corporate goals and strategic priorities. Of note is that each planned activity is aligned to at least two corporate goals and, not surprisingly, the greatest expected impact is in the areas of supporting generation of discoveries and developments by leveraging partnerships, collaborations and emerging technology platforms, and cultivating a world class R&I system – corporate goals three and two respectively.

Through delivery of funding programs, network development and bridging the gap between researchers, industries and other governments, we will utilize the resources at our disposal to further Alberta Innovates' contribution to the province as detailed in the corporate goals and strategic priorities.

Key Actions	Description	Corporate Goals				
		1	2	3	4	5
Emerging technologies capacity building programs	To grow and sustain the talent pool (graduate students, post docs, research associates) Alberta requires to be an innovative, diversified, globally competitive jurisdiction, funding for strategic research projects and chairs, graduate student scholarships and post-doctoral fellowships will support top-tier research teams, labs and individuals conducting research in Emerging Technology Areas at Campus Alberta Research Institutions. In addition to building Alberta's high-technology talent pool, these investments generate and translate knowledge towards developing new technologies and future market/industry needs in emerging technology areas. Capacity-building funding also includes portions of the support for GlycoNet, the Alberta-based pan-Canadian centre leading research in glycomics and carbohydrate research and discovery; and the Alberta Machine Intelligence Institute (Ami), based in Alberta and one of three major pan-Canadian institutions specializing in artificial intelligence and machine learning. Additional capacity building activity includes support for Quantum Alberta.	X	X	X		
Emerging technologies capacity utilization programs	Over the years Alberta has invested in building capacity in the form people, knowledge, technologies and infrastructure. Ensuring the generation of additional value from these investments requires intentional program delivery to ensure the capacity is utilized. Funding for MITACS internship program, Campus Alberta Small Business Engagement (CASBE) and Strategic Networking & Development grants to utilize Alberta's high-tech talent pool, connecting highly qualified personnel from within Campus Alberta to industry, public and non-profit partners, supporting collaboration and knowledge transfer. Additional planned capacity utilization funding initiatives/pilots include partnered strategic research projects and other approaches levering NSERC funding, which will support Campus Alberta-industry/public/non-profit collaborations (I2I, challenge-based calls)	X		X	X	

Emerging technology facilities	Capacity utilization funding is also provided for ACAMP, which provides infrastructure and technical support for development of later-stage nanotechnology solutions, helping Alberta grow a globally competitive, critical mass of commercial micro-nanotechnology companies. Additional facility support is intended for nanoFAB, AMIF, the CNC pilot plant.		X	X	X	
Investment in artificial intelligence/machine learning	Artificial intelligence and machine learning will play a major role in virtually all sectors of the economy as demand for knowledge, technology and skilled personnel has exploded to the point that an unprecedented opportunity lies before Alberta. With continued and increased investment in Amii and other vital components of the AI system, Alberta is very well positioned to enable and significant positive economic impact.		X	X	X	X
Academic entrepreneurialism	The Institutional Support for Entrepreneurial Education program provides funds to support organizations providing entrepreneurship education programming to students, including post-secondaries, RIN organizations, and Alberta non-profit organizations. Additional activities for academic entrepreneurialism include a pilot of a new entrepreneurial fellowship program similar to GreenSTEM from EDT, which supports recent graduates and academics to shift their focus from academically focused outcomes to the creation and development of new start-up companies.			X	X	
Stakeholder engagement and expertise recruitment	A key activity that will be undertaken is continued and new stakeholder engagement for many PSI programs. Examples include outreach to post-secondary institutions and RINs to enhance the ISEE program and gain better understanding of the most effective and efficient delivery and management practices for partnership with post-secondary institutions. Additionally, the PSI team will develop new relationships to enhance AI's expertise in emerging technologies by creating a strategic expert panel and identifying individuals on as needed basis to provide additional knowledge of global Emerging Technology industries and developments. This is to gain valuable external validation, advice and criticism to support the trusted role we have in oversight and stewardship of public resources.		X	X		X
Federal government engagement and partnerships	Recently, the Government of Canada and its agencies including NSERC, SSHERC, CIHR and NCE has made significant changes to the way they support R&I. This represents an opportunity for Alberta Innovates to establish new relationships and build on existing ones while influencing the new direction these changes will take as well as identify specific opportunities to increase federal funding contributions to Alberta-based innovation activity	X	X			X

APPLIED RESEARCH

C-FER Technologies

C-FER Technologies provides applied engineering services and testing to advance safety, efficiency and environmental performance in partnership with the energy industry. Examples of these services include assisting entrepreneurs in developing, testing and demonstrating their new technologies for industry end users (technology push) and helping end users identify the best available technologies and validating the performance of these technologies in independent, full-scale or field tests (technology pull). We also provide bridging services by working with industry to develop new technical standards to ensure the safe, reliable and efficient implementation of new technologies.

C-FER will contribute to data-enabled innovation by expanding its engineering and data analytics services for the design, operation and maintenance of oil and gas wells and pipelines. This will include developing new methods for performing engineering analysis of large data sets and creating new approaches using data analytics combined with engineering fundamentals to increase reliability and reduce risk. We will also be offering advanced engineering models commercially.

To advance clean energy technologies, we will assist situ oil sands operators in evaluating new well completion equipment and production technologies that have the potential to significantly increase well productivity and reliability and decrease energy, greenhouse gas and water use intensity**. C-FER** will also promote the application of thermal well technologies and expertise to geothermal systems to help reduce greenhouse gas emissions from power generation and oil sands operations, as well as to help diversify the oil sands supply chain into supporting the worldwide geothermal energy market. Assisting pipeline companies with design, reliability tracking, leak detection and spill response to reduce the frequency and consequences of incidents will also contribute to the advancement of clean energy technologies.

The key barrier to achieving these objectives is the ongoing lack of investment from the energy industry due to depressed oil prices and the lack of access to world markets for petroleum products. There is also a lack of investment and regulatory framework in Alberta for geothermal. At the same time, opportunities for new technologies will likely emerge as the energy industry focuses its attention on increasing the reliability and efficiency of their operations.

C-FER will continue to work closely with oil and gas and pipeline operators and equipment vendors to identify opportunities to participate in major initiatives such as the Climate Change Innovation Technology Framework (CCITF) and Water Innovation Program (WIP) that are managed by Alberta Innovates. This will include expanding the industrial-scale implementation of geothermal energy for direct use and power generation. We will also lead research into inland spill response technologies, practices and training and improve well integrity and abandonment to reduce environmental impact and long-term liabilities for the province. The testing and refinement of new oil sands recovery technologies will be supported to reduce energy and water use and greenhouse gas emissions.

We will also continue to participate in industry consortia focused on innovation and new technologies for the energy industry such as the Canadian Oil Sands Innovation Alliance (COSIA) and Clean Resource Innovation Network (CRIN), Canadian Energy Pipeline Association Foundation (CEPA Foundation) and Pipeline Research Council International (PRCI).

Work in these areas will build on **C-FER's** current expertise and facilities by developing new skill sets, attracting new staff with different skill sets and building new facilities to meet the changing needs of industry.

Key Actions	Description	Corporate Goals				
		1	2	3	4	5
Adapting oilfield technologies to geothermal	Adapt oilfield technologies developed in Alberta to support the development of Enhanced Geothermal Systems in Alberta and worldwide	X	X	X	X	X
Inland spill response	Validate the performance of spill response equipment for inland aquatic environments and construct a unique field-testing facility to simulate full-scale river environments for testing and training	X	X		X	X
Wellbore technologies for solvent processes for oil sands	Conduct large-scale laboratory tests to validate the performance of new processes and equipment for solvent-based production of oil sands	X		X	X	
Pipeline system integrity management	Expand risk-based, quantitative integrity management services of pipelines to include facilities and underground storage using cloud-based computing resources and software-as-a-service approach	X	X	X		X
Expand client base	Work with ED&T in Latin America and Asia to identify new clients for conventional services and opportunities to develop new services	X		X	X	X
CCITF participation	Participate in CCITF initiatives and Calls for Proposals related to Technology Development, Facilities, and Technology Commercialization	X	X	X	X	X
Unconventional oil and gas	Support development and implementation of new technologies and best practices to improve the efficiency and environmental performance of oil and gas operations using multi-zone hydraulic fracturing processes.	X		X	X	

InnoTech Alberta

As a subsidiary of Alberta Innovates, **InnoTech Alberta** plays a unique role by linking basic research and technology innovation with industry needs. **InnoTech Alberta** acts as the bridge between early research and industry, allowing it to focus on both push and pull research.

Our value proposition in the innovation system is our unique expertise and infrastructure, which basic, applied and industry researchers can leverage to develop new technologies and solve problems. As this bridge, **InnoTech Alberta** serves a crucial, stable function that cannot be reliably sustained by private enterprise. It is a fundamental strategic advantage to Alberta as public interest needs and priorities are explicitly delivered at no net cost to taxpayers. We also accelerate technology development by having the expertise and infrastructure in one place, holding intimate knowledge of Alberta Innovates and other government funding processes, and by maintaining strong relationships with industry that allow us to work directly with them to solve their problems through the implementation of technology. their technological needs.

InnoTech Alberta has a competitive advantage thanks to the high-quality expertise of our staff, our extensive infrastructure, and a unique business model that generates revenue and allows for flexibility for technology development. We can also assist researchers in acquiring early funding or leveraged funding for projects while at the same time offering advanced technological solutions to industry clients. **InnoTech Alberta** has the ability to perform early-stage lab work, create demonstration facilities, perform full-on field trials with clients, and assist in product development. Examples of such facilities include **InnoTech's** cellulose nanocrystals (CNC) pilot plant in Millwoods, the Fermentation Lab facilities in Vegreville or the advanced welding lab in Devon. As far as strategic areas, InnoTech Alberta has projects within clean technology and is currently leading an initiative to grow the presence of additive manufacturing in Alberta.

Another major component that separates **InnoTech Alberta** from its parent company, Alberta Innovates, or other government agencies, is the generation of revenue to meet expenses. Because we deal directly in solving industry needs, many projects and parts of infrastructure are privately funded, which helps us leverage our government-funded research.

InnoTech Alberta has three primary stakeholders – government, Alberta Innovates and industry. Because of this, projects and programs are funded in three ways:

1. Government-funded research
2. Leveraged research (industry funding or in-kind support and government funding)
3. Industry-funded research (fully private funding)

While research is done in the adoption of the four core emerging technologies in our existing resource sectors,), our role as the bridge in the Integrated Service Provider Framework means that we also assist our industry with specific needs that may fall outside of our core emerging technology focus areas.

Another way **InnoTech Alberta** is unique in the innovation system is its ability to quickly adapt to changing markets. For instance, the ongoing pressure the oil and gas industry is experiencing has led to a decrease in overall funding for the sector. However, many support industries of oil and gas are looking for new areas to work in, such as additive manufacturing, and we are able to quickly ramp up capabilities to support these emerging market segments. Further, we can help industry realize the potential business value of new and developing technologies, thereby reducing the risk of companies looking to invest in advanced technology.

Key Actions	Description	Corporate Goals				
		1	2	3	4	5
Growth of industrial additive manufacturing	Additive manufacturing expertise is being added at InnoTech including programming and robotics specialists that complement the materials and process individuals already in place. Along with personnel, equipment capacity is being added in partnership with the University of Alberta and industry players.	X	X	X	X	
CNC (cellulose nanocrystals)	The fully functional pilot facility continues to refine the production process making it more economical before a full scale, private facility is invested in. Further, the program continues to investigate the many uses of CNC product for various Alberta based applications.	X	X	X	X	X
MARIOS Consortium	This consortium consisting of over 20 supplier members and major oil sands producers continues to drive technology development for the oil sands making it more economical and reducing maintenance costs for the industry.		X	X	X	X
Mesocosm Test Facility	The development and construction of the terrestrial mesocosm facility was a joint-partnership initiative between InnoTech Alberta and the University of Alberta, with funding provided through the Helmholtz-Alberta Initiative. The mesocosm facility now houses 16 terrestrial mesocosms on a secondary containment pad, permitting the secure testing of chemical constituents and materials that are reputed to have harmful effects on the environment.	X	X	X	X	
Engineered Composites Panel Pilot Plant	The Engineered Composites Panel Pilot Plant is one of the most highly-automated and -sophisticated panel development laboratory in North America. This scale-up facility simulates the operating environment of an industrial sawmill, to allow companies to explore new ideas and conduct trials without interrupting their own production lines. The plant produces a range of strand-based and fibre-based panels, particle boards and laminated products.	X	X	X	X	X
Alberta Carbon Conversion Technology Centre (ACCTC)	The Alberta Carbon Conversion Technology Centre (ACCTC) was recently established in Calgary to test and advance carbon capture and conversion technologies that accelerate greenhouse gas emission reductions by enabling the commercially viable conversion of carbon into value-added products.	X	X	X	X	X
Crop Production Research Farm	Our Crop Production Research farm sits on 600 acres on the western outskirts of Vegreville. The research conducted on the farm includes new crops research on crops, such as industrial hemp, as well as agronomic research on traditional crops, such as canola and barley. Every summer up to 3,000 individual plots are grown and harvested on the farm. The type of research conducted ranges from herbicide and fungicide efficacy to variety comparisons to drought tolerance to native plants.	X	X	X	X	

Fermentation Plant	The Fermentation Plant houses 20 fermenters ranging from 20L to 15,000L, along with associated downstream processing equipment. The facility is used to develop, optimize and scale biological processes to assist customers in the deployment and commercialization of novel technology. The facility has been in operation for over 30 years and has worked with a broad range of organisms and processes. The facility is important, as most companies cannot afford to develop this equipment or expertise in-house for a process under development.	**X**	**X**	**X**	**X**	

APPENDIX C:
Emerging Technologies: Core Four Initiatives

As outlined in our five-year strategic plan, we will facilitate the growth and development of emerging technologies in Alberta that have demonstrated potential for high return and lower risk, with a focus in four core areas. The tables below highlight a sample of initiatives in each of the four core areas that we either currently have underway or are on the horizon.

Data-Enabled Innovation	
Initiative	**Description of the Opportunity**
Sensors, drones, automated systems	Agriculture is currently experiencing a revolution through the integration of technology, particularly sensors, drones and automated systems to collect data at all points of crop and livestock production. Using data-enabled innovations, the information collected on weather, growth patterns as well as crop and animal health is being transformed into recommendations for farmers to improve their production practices, reduce their impact on the environment and increase their profitability.
Optimizing the treatment of drinking water using reinforcement learning	AI is supporting ISL Adapt Ltd. to create a reinforcement learning controller for automation of a pilot water treatment plant that is also scalable to a full water treatment plant and adaptable to other water treatment facilities and future commercialization. The project will identify key components required to create a fully functioning reinforcement learning system prototype (hardware, software, communications protocols, and support services) and what is needed to fully integrate the technology into an existing system. Alberta Machine Intelligence Institute (Amii) is providing the technical support and the system is being tested at the Town of Drayton Valley.
Alberta Data Institute	The newly formed Alberta Data Institute, in partnership with Alberta Machine Intelligence Institute (Amii) and Alberta Bone and Joint Institutes, are engaging on a targeted pilot project to demonstrate how artificial intelligence can help achieve improved healthcare objectives. This innovative project will seek to predict adverse effects and revision-rate outcomes for patients with primary hip replacements. If the predictive analytics are successful, the project will offer a clear path to scale appropriate treatments with its partners.
Alberta Machine Intelligence Institute (Amii)/ artificial intelligence	Through our support for Amii and artificial Intelligence, we are making investments that have real-world applications in many sectors. Amii has developed technology for worker scheduling that has potential to save millions of dollars in health spending. Another application is functional MRI image analysis by computers for diagnosing conditions such as mental illness and breast cancer. In energy and transportation, Amii has conducted projects to optimize the use of rail cars for distribution of and transport

	of oil. Subsurface imaging and reservoir characterization are also areas where artificial intelligence is being applied to help the energy sector be more efficient in extraction.

Digital Technology for Business Transformation	
Initiative	**Description of the Opportunity**
Food supply – blockchain application	There is growing demand from consumers to not only have healthy and nutritious food, but also to know where the food was produced, and that production was done in a safe and ethical manner. Tracking and authenticating the food supply chain from "farm to table" will only be possible through the acquisition and management of data from multiple sources along the value chain. One potential solution could be the implementation of blockchain technology linking data gathered from primary agriculture product, food manufacturing and retail/food service in a way that addresses consumer expectations and returns value to all participants in the blockchain. The use of a blockchain approach will not only be a step to building domestic and international consumer trust in the food supply chain, it can also be used for real-time food tracing back to origin in the case of food safety recalls.
Robotics in building construction	In bioindustrial production, digital technology enhancement of building construction using green building materials is being explored. Robotics are being incorporated in building construction through work at University of Alberta in co-operation with Landmark Homes.
Digital data application for ecosystem services	In the area of ecosystem services, digital data acquisition and manipulation is being managed through the company Silvacom and available to natural resource managers and the public through online data systems such as BRIMS (BioResource Information Management System). Digital data is collected on a vast array of resource components, valuation is conducted and models are developed to assist resource managers, government agencies and investors to make sound resource management decisions.
Ambyint High-resolution controller for artificial lift automation	Ambyint is developing a high-resolution adaptive controller based on edge computing and machine learning that can execute complex calculation and analytics in real-time, can integrate with existing wellsite automation and ancillary equipment. This technology will enable autonomous control and optimization of oil and gas wells increasing production up to 10% and reducing costs by up to 20%.
Opryx	Opryx, a health company, developed an Internet-of-Things connected sensor that monitors and relays alerts to patients with diabetes. This technology predicts risks to foot health, allowing the patient and care-provider(s) to reassess and manage clinical intervention to prevent critical foot issues that have become common for patients with diabetes.

mmHG	mmHG is developing an Internet-of-Things connected blood-pressure monitoring system that predicts the possibility of having an adverse pulmonary event, such as a heart attack, and alerts health-care providers remotely so that they can intervene before the event occurs.
TestFire Labs	TestFire Labs created Hendrix to transcribe meeting notes and organize action items. In future, this type of digital tech innovation might include systems that keep your contacts up to date, pre-populate meeting agendas and create a work plan aligned with strategy and operational plans. At home, that might mean co-ordinating a family's schedules and ordering transportation and food, when needed.
HiFi	Internet of Things (IoT) is all about sensors gathering large amounts of data to make better, more informed decisions. We currently support this via firms like HiFi, which uses a fibre optics sensor to detect leaks in pipelines. We envision digital technology transforming our lives with miniature battery-less sensors that harvest energy from radio waves or movement, and automatically populate a database that can help decision-makers decide how to deploy resources. For example, a municipality could know how many garbage trucks will be needed on a particular city route based on individual household waste.

Clean Technology	
Initiative	**Description of the Opportunity**
Alberta Smart Grid Consortium projects	The Alberta Smart Grid Consortium consists of Alberta Innovates, Alberta Energy and the Alberta Distribution Facility Owners (DFOs), ATCO, ENMAX, EPCOR, FortisAlberta, Alberta Federation of Rural Electrification Associations (AFREA), EQUS, and the Cities of Lethbridge, Medicine Hat and Red Deer. The purpose is to work collaboratively to accelerate the development and deployment of smart grid technologies that will enable the consortium members to understand the impacts these technologies may have on the electricity grid and the potential opportunities they might create. The consortium currently has four technology demonstration projects underway. 1. City of Lethbridge – Conservation Voltage Reduction Pilot 2. ENMAX – Integrating Distributed Generation into Secondary Networks 3. EQUS REA – Rural Alberta Smart Grid EPCOR – Smart Grid System
Abandoned wellsite reclamation	It has been estimated that the financial cost of reclaiming more than 150,000 inactive oil and gas wells in Alberta could reach several billion dollars. Reclamation at many of these sites is stalled due to the technical challenges and costs associated with remediating contaminated soil and groundwater. The Remediation Research and Technology Innovation (RRTI) program has been proposed to spur development of new

	technologies and best management practices that will more effectively address high-priority contaminants (e.g., petroleum hydrocarbons, salts, BTEX, etc.), drive down remediation costs (including through the adoption of digital innovations) and reduce the amount of soil being landfilled
Clean O2	Clean O2 has created carbon capture system that reduces energy demands through heat recovery and uses a unique carbon capture process to produce a valuable byproduct that can be used to treat water.

Innovative Production & Distribution	
Initiative	**Description of the Opportunity**
Food manufacturing ***Bioindustrial development***	One of the key competitive issues facing Alberta's food manufacturing sector is access to and retention of labour. Accelerating the development, commercialization and adoption of "made in Canada" solutions for the agri-food sector will improve quality and safety of the food we produce and improve production efficiency. Harnessing big data and artificial intelligence to make informed production decisions and incorporating emerging technologies such as vision systems, autonomous and robotic systems will establish Alberta's small-and medium-sized food manufacturers as leaders. Innovative uses of agriculture and forest biomass underpins Bio team's efforts in bioindustrial development. New materials and composites of these materials are the focus of research funding. Biomass such as CNC, CNF lignin and hemp have received significant attention in many jurisdictions. Our goal is to see new products and new processes leading to industrial growth and wealth creation in Alberta.
Enerkem Alberta Biofuels	The Enerkem Alberta Biofuels demonstration plant is a collaboration between Enerkem, the City of Edmonton, Alberta Energy and Alberta Innovates. This facility contributes to the diversion of municipal solid waste and the conversion of these wastes to methanol and ethanol fuels. The innovative production technology represents important advancement in the management of waste and creation of marketable products. Connected to the commercial demonstration facility, the Advanced Energy Research Facility (AERF) was also established by Alberta Innovates and the City of Edmonton in 2013 to scale up new conversion technologies and attract investments to Alberta. This facility has been home to innovators with a dozen R&D projects that accelerate new technologies for waste to value-added products.
Bitumen Beyond Combustion	Bitumen Beyond Combustion focuses production of non-combustion end-use products that have the potential to utilize over 100,000 bbl/day of bitumen. Production of carbon fibres, asphalt, polymers, and vanadium for flow cell batteries are the four key products of interest in the program. Market demand is growing for these four products with future market valuations currently projected at $77+ billion, $50+ billion, $600+

	billion, and $130+ million, respectively; thus, capturing a portion of these markets would result in significant benefits for Alberta. With world population projected to grow to nine billion by 2050, BBC products can help meet the basic material needs of the existing and growing world population.
Attabotics	Attabotics is an innovative firm that created a system to manage inventory in a smaller footprint by using robots and software. We can envision demand-driven logistics, supply chain and production systems that connect consumer needs to manufacturing. For example, if a company needs a part, the request is sent to a micro factory in Alberta that prints the part as needed.
ACAMP ***NanoFab*** ***AMIF***	We have long supported facilities across the province for development and manufacturing of novel high-tech products in the micro and nanoelectronics industry. A company that wants to design a sensor for application in autonomous vehicles, pipeline leak detection or medical devices can take its prototype or proof of concept to one of several facilities, including ACAMP, NanoFab, or AMIF, and have its design optimized and then manufactured. These facilities have state-of-the-art equipment. Without them, Alberta companies would have to find and pay full cost for similar services elsewhere in North America or Asia. Innovative production has included many types of advanced manufacturing - functional 3D printing, chip manufacturing and other fabrication technologies.

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