

EMISSIONS
REDUCTION
ALBERTA



Investing in technologies
for a lower carbon future.

2017-2020 BUSINESS PLAN

April 2017

Emissions Reduction Alberta's (ERA) budget and Business Plan for the period June 1, 2017 through May 31, 2020 was prepared in accordance with the requirements of the Climate Change and Emissions Management Fund Administration Regulation, which is enacted pursuant to the Climate Change and Emissions Management Act.

All of ERA's policies, accountability obligations and relationships have been considered in preparing this budget and Business Plan. As well, the Government of Alberta's business plan, public policy statements such as the Climate Leadership Plan and the business plans and priorities of relevant government departments such as the Alberta Climate Change Office, Alberta Economic Development and Trade and Alberta Energy were considered, along with the climate related technology needs of Alberta's industry and innovation system.

ERA is committed to achieving the planned results laid out in this budget and Business Plan, approved by the ERA Board of Directors.

WE ARE EMISSIONS REDUCTION ALBERTA

We are Emissions Reduction Alberta – ERA.

We are innovators. We are builders. And we are ground breakers.

We invest in and propel promising technologies that reduce greenhouse gas (GHG) emissions along the path of innovation from idea to market. Our plans are big and our vision is ambitious.

We know imagining new possibilities is the first step to advancing innovation.

As innovators, we imagine a better future. A sustainable, lower carbon future. One we can create together.

Imagine a future where industry, innovators and government are aligned on common outcomes.

Imagine a future where entrepreneurs and industries operate to a higher standard of economic and environmental sustainability.

Imagine a future where scientists, researchers and technology developers get the support and investment they need to develop and commercialize game-changing technologies. And where those technologies pave the way for new companies and new industries.

Imagine a future where emissions are captured and used to create everyday products – from chemicals and fertilizers to cement and hockey sticks.

Imagine a future where new technologies mean new jobs – where thousands of Albertans go to work creating cleaner, more sustainable energy sources every day.

And where those cleaner, more sustainable sources of energy power our homes, businesses, industries, and communities.

Imagine a future where those who share and support our vision know they are helping to create a better province for future generations.

Imagine a future we can build together where Alberta's reputation is synonymous with economic growth, community health and environmental leadership on a local, national and global scale.

This future is possible. It will take work. But we know it will be worth it.

As builders, our investments are a cornerstone in the foundation for a prosperous Alberta with a diverse economy, a healthy environment, and technologies that are sought throughout the world. This type of progress takes time and sustained commitment.

ERA has proven that this progress is possible.

Our efforts are helping to create tomorrow. From supporting inventors to collaborating with investors and industry, we are working together to identify and develop solutions that address our most urgent challenges.

Doing the same thing better is no longer enough. We need to develop new ideas that lead to new technologies and new products.

As ground breakers, we know there's no reward without risk. ERA is investing in a diverse portfolio of transformative, sustainable technologies that reduce emissions. This is our moment to push technology beyond conventional limits. We have the opportunity not only to innovate, but to change the game entirely.

But we need to act now.

In the future, we should never have to ask ourselves if we have done enough. We can produce oil with lower emissions. We can create power from landfill waste. We can eliminate methane emissions. And we can create a stronger innovation ecosystem that generates new industries and jobs in Alberta. We have the people, the resources and the drive to do all of this and show the world that Alberta can be a leader in clean energy production.

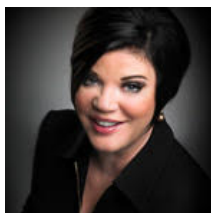
The future is uncertain, but our ability to make a difference has never been clearer. The world is calling for action – ERA is responding.

Our actions will help define who we are as a province, and how the world sees us as clean energy leaders.

We are dreamers – but we are also doers. Together, we can do more than imagine a better future. We can build one. A future that our families and communities will benefit from, and one we can all be proud to have helped create.



MESSAGE FROM THE CHAIR



At Emissions Reduction Alberta (ERA), we know that imagining new possibilities is the first step to advancing innovation. We're accelerating families of technologies that have the potential to deliver step changes in how we produce and use energy.

Imagine if the waste we send to landfills today could be used to produce useful products tomorrow. Workers could be employed at sites across Alberta to manage complex waste management facilities that provide electricity, biofuels, compost and other valuable materials for their local communities. Municipalities could have access to new revenue streams.

Imagine if we could eliminate methane emissions in Alberta. Methane's impact on climate change is 25 times that of carbon dioxide. In 2014, methane emissions from the oil and gas sector were responsible for over 30 megatonnes of carbon dioxide equivalent in GHG emissions. Alberta is leading in policy and technology to address this issue.

Imagine if we were able to drastically reduce the need for heat and water to recover bitumen from the oil sands. Innovative extraction technologies have the potential to reduce GHG emissions by 50 per cent or more for every barrel of oil produced.

This is our future – a future that ERA is helping to build.

To get there, we're working closely with government, industry and innovators to ensure alignment with policy direction, and to support promising technologies sought by the market. We are also putting the right delivery mechanisms in place – an efficient business model, a balanced project portfolio, robust performance metrics, and the stable, predictable funding needed to support the best and the brightest ideas.

It's not a distant dream.

This is our moment. Let's make it count.

Sincerely,

A handwritten signature in black ink that reads "K. Sendall".

Kathy Sendall, C.M., LL.D.
Chair
Emissions Reduction Alberta

MESSAGE FROM THE CEO



ERA is helping this province become the best place to turn ideas into products, and products into companies.

We are on the right track.

We have rebranded our organization to provide greater clarity around our mandate. In the coming year we are continuing our efforts to advance operational excellence by assessing our business delivery model to ensure we remain efficient and responsive.

Collaboration is key – and we’ve benefitted greatly from strong partnerships with organizations such as Alberta Innovates and Sustainable Development Technology Canada (SDTC). We learn from each other, and we will build on this experience and continue to broaden our network over the coming years.

Our Technology Roadmap serves as our compass, providing the direction we need to make wise investment choices that support the outcomes of the Climate Leadership Plan and meet the needs of industry and innovators. This Roadmap will guide our portfolio for years to come.

And through it all, we support the innovators who strive to advance the technologies the world demands. We will strengthen our capacity to accelerate development of the strongest technologies and we will connect innovators to the supports they need to be successful.

Together, government, industry and innovators are advancing a common vision. By leveraging the incredible capacity and goodwill in this province we can chart a path forward for the clean and innovative technologies Alberta needs to be successful in a lower carbon future.

Sincerely,

A handwritten signature in black ink, appearing to read 'S. MacDonald'.

Steve MacDonald
CEO
Emissions Reduction Alberta

ERA CORPORATE OVERVIEW



Mandate

To identify and accelerate innovative solutions that secure Alberta's success in a lower carbon economy.



Vision

Alberta is recognized as an innovation and technology leader in a lower carbon world.



2017 – 2020 Strategic Priorities

To achieve its vision and mandate, ERA will:

- 1. Accelerate GHG reducing technologies**

Fund innovative solutions that result in meaningful GHG emissions reductions in Alberta and contribute to a lower carbon world.

- 2. Advance innovation system priorities**

Leverage our strengths to contribute to critical climate change innovation priorities in Alberta.

To deliver on priorities 1 and 2, ERA will:

- 3. Measure and communicate success**

Define and report on metrics to demonstrate results.

- 4. Advance operational excellence**

Strive for excellence in operations and efficiency while maintaining responsiveness to stakeholders and funders.



Core Values

Leadership, innovation, collaboration, transparency, integrity

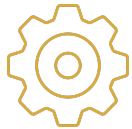
Key Performance Metrics



Environment: GHG emissions reductions



Economy: direct investment, GDP impact, job creation



Technology: project technology readiness level¹ (TRL) progression



Community: stakeholder awareness and attitudes

¹ Technology Readiness Levels (TRL) are a type of measurement system used to assess the maturity level of a particular technology. TRL ratings are assigned based on the project's readiness. TRL 1 (scientific research) is the lowest and TRL 9 (proven/commercialized) is the highest.

TABLE OF CONTENTS

WE ARE EMISSIONS REDUCTION ALBERTA	iii
MESSAGE FROM THE CHAIR	v
ERA CORPORATE OVERVIEW	vii
Mandate	vii
Vision	vii
2017 – 2020 Strategic Priorities.....	vii
Core Values	vii
Key Performance Metrics	viii
1.0 EXECUTIVE SUMMARY	1
1.1 Strategic Priority #1: Accelerate GHG Reducing Technologies	4
1.2 Strategic Priority #2: Advance Innovation System Priorities.....	5
1.3 Strategic Priority #3: Measure and Communicate Success.....	6
1.4 Strategic Priority #4: Advance Operational Excellence	7
2.0 ABOUT OUR ORGANIZATION	8
2.1 We Are Emissions Reduction Alberta	8
2.1.1 New Brand.....	9
2.2 We Are Accelerating Emissions Reductions	11
2.3 We Are Part of a Larger Plan	13
2.3.1 Supporting Alberta’s Climate Leadership	13
2.3.2 Aligning with Alberta’s Innovation System	14
3.0 STRATEGIC CONTEXT – THE CHALLENGE	16
3.1 The Technology Imperative.....	16
3.1.1 Achieving GHG Reductions in Multiple Timeframes.....	16
3.2 Critical Innovation System Gaps.....	17
3.2.1 Market Pull and Policy Push.....	17
3.2.2. Business Development and Competency Gaps.....	17
3.2.3 Lack of Capital and Stranded Grants	18
3.3 Aligning Efforts Through a Complete Solutions Approach.....	19
4.0 SUCCESSFULLY ACCELERATING INNOVATION	20
4.1 Technology Roadmap	20
4.1.1 ERA Technology Roadmap Investment Areas of Focus	20
4.2 Strategic Initiatives and Partnerships.....	22
4.2.1 Partnership Intake Pilot	22
4.2.2. Innovator Support Pilot	23
4.3 Future Funding Opportunities	25

4.3.1. Technologies to Help Meet the 100 Megatonne Per Year GHG Emissions Limit for the Oil Sands	25
4.3.2. Technologies to Optimize Biological Resources.....	27
4.3.3. Technologies to Support the Phase-out of Coal and Increase Non-emitting Electricity	28
4.3.4. Technologies to Encourage Industrial Process Efficiency	28
4.4 Ongoing Operational Improvements	31
4.4.1 Business Delivery Model Assessment.....	31
4.4.2 Biological Program Assessment.....	31
5.0 STRATEGIC PRIORITIES	33
5.1 Strategic Priority #1: Accelerate GHG Reducing Technologies.....	34
5.2 Strategic Priority #2: Advance Innovation System Priorities	37
5.3 Strategic Priority #3: Measure and Communicate Success.....	39
5.4 Strategic Priority #4: Advance Operational Excellence	41
6.0 MEASURING SUCCESS.....	43
6.1 METRICS APPROACH.....	44
6.2 PERFORMANCE MEASURES AND REPORTING	46
7.0 OPERATING BUDGET	47

1.0 EXECUTIVE SUMMARY

At Emissions Reduction Alberta (ERA), we are imagining a new era of possibilities.

By supporting the deployment of promising technologies and accelerating the development of game-changing innovation, we are working to reduce greenhouse gas (GHG) emissions and secure Alberta's success in a lower carbon economy.

ERA is a key partner in implementing Alberta's Climate Leadership Plan and meeting the province's 2030 Innovation Targets. Our funding, which comes from the Government of Alberta's Climate Change and Emissions Management Fund (CCEMF), is helping to shape a province with a diverse economy, a healthy environment and a robust innovation ecosystem.

ERA Quick Facts:

(As of February 2017)

Total projects:

109

Total funds committed:

\$334 million

Total project value:

\$2.2 billion

GHG reductions by 2020:

7.5 MT

GDP impact in AB by 2021:

\$1.8 billion

Job creation in AB by 2021:

15,500 person-year³ jobs

Created in 2009 as the Climate Change and Emissions Management Corporation², our organization was rebranded in 2016, to make it clear that we are a part of Alberta's climate change efforts and to better reflect our mandate.

Although our name has changed, ERA's commitment to reducing GHG emissions has never been stronger. Our close relationship with the newly consolidated Alberta Innovates organization remains critical, and we continue to review and assess our business model to ensure we are efficiently, effectively and transparently delivering results.

Since 2009, ERA has committed more than \$330 million to over 100 projects. Our portfolio represents a total project value of approximately \$2.2 billion. Our focus is on technologies that have the most potential to help Alberta achieve its ambitious, long-term GHG emission reduction goals. However, we have also funded demonstration and deployment projects that are already reducing GHGs, and are estimated to

achieve more than seven megatonnes in cumulative net emissions reductions by 2020.

ERA's investments contribute significantly to the provincial economy. A 2017 study by Alberta's Department of Economic Development and Trade found that ERA's projects are expected to result in direct economic benefits to Alberta of approximately 4,000 person-year jobs and \$485 million of GDP growth between 2011 and 2021. When indirect and induced

² The CCEMC legal name continues to exist but is not public facing. Emissions Reduction Alberta (ERA) is a legal trade name of Climate Change and Emissions Management (CCEMC) Corporation.

³ A person-year job is equal to one year of employment for one individual.

economic impacts⁴ are included, ERA and related investments are expected to result in more than 15,000 person-year jobs and GDP growth of approximately \$1.8 billion over the same ten-year period.

ERA's portfolio includes projects that will address Alberta's climate leadership priorities and 2030 Innovation Targets, including reducing emissions in the oil sands, reducing methane emissions, phasing out coal-fired electricity generation, and increasing deployment of renewable energy. We invest in the solutions that industry needs to address the problems Alberta must solve today, while also seeking out transformative technologies to address Alberta's largest sources of GHG emissions over the longer term.

To ensure our investments respond to Alberta's climate change needs and priorities, we have established four key strategic priorities. These include:

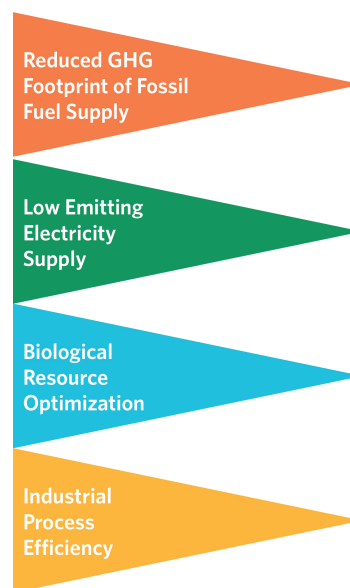
1. Accelerate GHG Reducing Technologies
2. Advance Innovation System Priorities
3. Measure and Communicate Success
4. Advance Operational Excellence

ERA has also developed a Technology Roadmap to guide our funding decisions and inform our portfolio going forward. The Roadmap defines technology pathways and areas of focus for future ERA investments that support Alberta's desired climate change outcomes. It can also assist the broader innovation system in aligning around common climate change and innovation investment goals and priorities.

Funding alone will not accelerate new technologies to commercialization. Today's innovators face significant and numerous challenges that hinder technologies from scaling up so they can be adopted by industry. Success requires backing innovative technologies with smart financing and strong business models, and creating an effective and efficient environment where good policies and strong regulatory frameworks enable us to deliver on our mandate.

Collaboration is critical to success, and ERA is working closely with partners from government, industry, and academia to secure a lower carbon future for Alberta. Together, we are helping to create complete solutions, including the suite of policy,

ERA TECHNOLOGY ROADMAP AREAS OF FOCUS



⁴ Direct impacts are those directly from the projects; indirect impacts come from the demand created by project investment; induced impacts are residual impacts to the economy.

regulatory, program, and business innovation tools required to address system challenges and deploy new technologies.

Alberta has articulated its desired climate change outcomes and priorities through the Climate Leadership Plan. This 2017-2020 Business Plan sets out the activities and the resources required for ERA to play a key role in achieving success. Our four strategic priorities, summarized in this executive summary and described in further detail in the sections that follow, provide the framework for our actions. ERA's \$100 million budget gives us the means to effectively execute on our Plan.

Critical among the actions we will undertake, is the delivery of two funding opportunities per year averaging \$40 million each, in alignment with the investment areas of focus established in our Technology Roadmap. These calls for proposals will be augmented by our Partnership Intake Pilot – an opportunity for ERA to fund innovative GHG-reducing projects that are brought forward by our trusted funding partners in the system. We have set aside \$15 million for the Pilot, which will allow us to consider funding promising technologies outside of our traditional call for proposal process, while leveraging the due diligence processes undertaken by partners like Alberta Innovates and Sustainable Development Technology Canada (SDTC).

At ERA, we are committed to helping Alberta become a recognized innovation and technology leader in a lower carbon world. In the pages that follow you will learn in greater detail how we are we doing more than imagining a better future – we are helping build one.

1.1 Strategic Priority #1: Accelerate GHG Reducing Technologies

Fund innovative solutions that result in meaningful GHG emissions reductions in Alberta and contribute to a lower carbon world.

What we plan to do

- *Rigorously select projects that facilitate GHG emission reductions and represent best-value for investment*
- *Strategically align portfolio investments with GOA priorities*
- *Engage with key stakeholders to understand and be responsive to Alberta Climate Leadership Plan policies as well as market demands*

What we plan to deliver

- *Innovative projects focused on reducing GHG emissions and addressing identified market needs in Alberta*
- *Investments informed by ERA's Technology Roadmap*
- *Quantitative sectoral GHG emissions analysis*
- *Host workshops, conferences and board events*

What we seek to accomplish

- *Increase investment in Alberta-based projects that will contribute to reducing GHGs in Alberta and Canada*
- *Increase jobs in Alberta's clean technology sectors*
- *Increase investment in solutions that align with Alberta's Climate Leadership needs, 2030 Innovation Targets, and Alberta's market demand*

Where we plan to have an impact

- *Eliminated coal-fired electricity generation emissions and increased renewable energy; reduced oil sands emissions; reduced methane emissions; and increased process efficiency*
- *Maintain Alberta's economic competitiveness*

What we plan to measure



GHG emissions reductions



Investment



GDP impact



Job creation

1.2 Strategic Priority #2: Advance Innovation System Priorities

Leverage our strengths to contribute to critical climate change innovation priorities in Alberta.

What we plan to do

- *Maintain existing and establish new partnerships that maximize and leverage shared investment capacity and expertise*
- *Facilitate strategic partnerships among projects and resource/knowledge suppliers*

What we plan to deliver

- *Leveraged investments*
- *Strong strategic partnerships in Alberta, Canada, and internationally*
- *Knowledge and resource sharing to support clean technology development*

What we seek to accomplish

- *Increase capital for innovation and technology*
- *Increase commercialization and long-term viability of GHG emission reduction technologies with identified consumers*

Where we plan to have an impact

- *Increased supply and use of clean technology, products and practices*
- *Increased skills and employment in clean technology sectors*
- *Accelerated adoption of clean innovation*

What we plan to measure



Number of projects



Investment leverage



Partnership and collaborative activities



Project technology readiness level (TRL) progression

1.3 Strategic Priority #3: Measure and Communicate Success

Define and report on metrics to demonstrate results.

What we plan to do

- *Monitor and evaluate progress of funded projects*
- *Communicate progress of ERA's funded projects*

What we plan to deliver

- *Reporting of project GHG emission reductions, economic impacts, and learning from technology development*
- *Stewardship Reports*
- *Participation, sponsorship and hosting of events aligned with ERA's mandate*

What we seek to accomplish

- *Increase awareness of value for investment for ERA funders*
- *Increase awareness of ERA's strengths and credibility as a leader in GHG emission reduction*
- *Increase recognition of Alberta as an innovation and clean technology leader*

Where we plan to have an impact

- *Increased support and engagement of Albertans*

What we plan to measure



Stakeholder awareness of and attitudes towards ERA



Number and impact of communications and outreach events



Contribution to Climate Leadership Plan measures and 2030 Innovation Targets

1.4 Strategic Priority #4: Advance Operational Excellence

Strive for excellence in operations and efficiency while maintaining responsiveness to stakeholders and funders.

What we plan to do

- *Incorporate information and learning to improve ERA's intake, evaluation, and funding processes*

What we plan to deliver

- *Alignment of operating actives with GOA priorities*
- *Business delivery model review*

What we seek to accomplish

- *Increase operational effectiveness and efficiency in ERA's decision making cycle*

Where we plan to have an impact

- *Alberta is recognized as a climate leader*

What we plan to measure



Operating costs as a percentage of approved project commitments



Length of ERA intake and decision-making cycle



Board effectiveness

2.0 ABOUT OUR ORGANIZATION

2.1 We Are Emissions Reduction Alberta

ERA was created in 2009, as the Climate Change and Emissions Management (CCEMC) Corporation to support Alberta's climate change goals.

We invest in transformative technologies to help create a sustainable and diversified economy that attracts investment, creates jobs, expands market access, and delivers improved environmental outcomes.

Aligned with Alberta's Climate Leadership Plan and 2030 Innovation Targets, ERA is an integral player in achieving these ambitious goals. While many jurisdictions have a mechanism to invest in clean technologies, the ERA model is unique. The province of Alberta provides ERA with grants that enable us to fulfill our mandate. Our funding is sourced from Alberta's large emitters who are required to reduce their GHG emissions to meet a regulated target. Such emitters may elect to comply with these regulations by paying into the Climate Change and Emissions Management Fund (CCEMF) if this option is less costly than physically reducing their emissions. The Fund is the source for grants to ERA.

Emissions Reduction Alberta by the Numbers:

(As of February 2017)

Total Projects: 109

Completed Projects: 59

Funds Committed: \$334 million

Total Project Value: \$2.2 billion

Since 2009, ERA has committed more than \$330 million in funding to more than 100 projects. ERA funding is leveraged, and for every dollar we invest, nearly six dollars are also invested by industry, innovators and other project funders⁵.

ERA is a Delegated Administrative Organization (DAO), which is incorporated under the Canada Not For Profit Corporations Act. While ERA operates at arm's length from the province, there are a host of regulatory and contractual mechanisms in place to ensure accountability to the government and responsibility for environmental stewardship in Alberta. These include a designating regulation, the Climate Change and Emissions Management Fund Administration Regulation, a memorandum of understanding (MOU) and a grant agreement. The Minister of Alberta Environment and Parks and the Minister Responsible for the Climate Change Office appoints the Chair of ERA. Like all DAOs, ERA is required to annually submit a business plan and an annual report to the Minister and is subject to the Freedom of Information and Protection of Privacy Act.

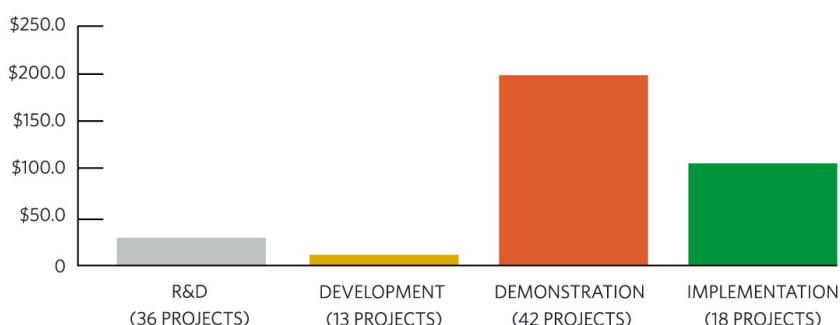
ERA's interest is in reducing GHG emissions, removing barriers to technology development and commercialization, and sharing the knowledge gained to accelerate the development of the

⁵ The leveraging figure is a ratio of ERA commitment to total project value. It is significantly influenced by Blackspring Ridge, a major wind project in southern Alberta. If that project is removed, ERA leveraging is about 4:1, based on our current portfolio.

technologies Alberta needs to meet its climate change goals. Our investments have focused on demonstration and deployment projects, but they span the innovation spectrum.

ERA INVESTMENT BY INNOVATION STAGE (ALL PROJECTS)

(\$ MILLIONS)



As an arms-length organization, we are well placed to deal with the risks of innovation, including failure. Our independent, transparent and rigorous due diligence and selection process is designed to minimize this risk. When projects are not successful we use the knowledge we gain from those experiences to innovate more quickly in all areas.

2.1.1 New Brand

Formerly CCEMC, ERA was rebranded in 2016, to make it clear that the organization is part of Alberta's climate change efforts and to better reflect ERA's mandate. The name change also speaks to changes in how we deliver on that mandate.

We are more actively managing our investments by adopting a systems or "complete solutions" approach, and through the development of a Technology Roadmap (section 4.1) to help guide our investments and ensure our portfolio is in strong alignment with policy direction and the needs of large emitters.

We are making additional strategic changes to accelerate technology development. These include actively seeking out new opportunities for collaboration, and piloting new mechanisms to fund promising technologies for reducing Alberta's environmental footprint (section 4.2).

Since its formation in 2009, ERA's business needs have been delivered by a network of service providers contracted to carry out specific functions, such as accounting, legal, and communications. To support our work, we are adding dedicated strategic and technical staff resources where it is the most efficient and effective (section 4.4).

Although our name has changed, our commitment to reducing GHG emissions has never been stronger. Our relationship with the newly consolidated Alberta Innovates organization remains strong, and existing partnerships like these remain critical to our success.

The CCEMC legal name continues to exist but is not public facing. Emissions Reduction Alberta (ERA) is a legal trade name of Climate Change and Emissions Management (CCEMC) Corporation. Existing contribution agreements do not change as a result of our new name; ERA continues to fund and support previously approved CCEMC projects.

2.2 We Are Accelerating Emissions Reductions

ERA is actively working to accelerate more than 100 projects that have the potential to reduce GHG emissions in Alberta.

While ERA's primary focus is on technologies that will reduce GHG emissions beyond 2020, ERA has also supported projects that have produced near-term reductions. These are estimated to achieve more than seven megatonnes in cumulative net emissions reductions by 2020, with additional market potential⁶ of more than four megatonnes by the same year.

In the year ahead, ERA will advance several important opportunities to accelerate GHG reducing technologies.

In spring 2017, we announced successful funding recipients under Round Two of the ERA Grand Challenge: Innovative Carbon Uses. The competition was designed to scan the globe for ideas that could be used in Alberta to turn carbon dioxide waste streams into valuable products. Round One gave up to \$500,000 to 24 projects to prove out early stage concepts. Round Two narrowed the field to four recipients who have each received commitments of up to \$3 million dollars to advance their technologies.

For the Grand Challenge projects, the ultimate aim is to provide a net GHG reduction of one megatonne (1,000,000 tonnes) annually. In Round Three of the Grand Challenge, one of the four groups from Round Two will be selected to receive a grant of up to \$10 million to advance their technology in Alberta. The Round Three Grand Challenge winner will be announced by 2020.

In 2017, we will also announce recipients from our joint call for proposals with SDTC. The call offered a unique funding opportunity to Canadian clean technology innovators and entrepreneurs. Together we made up to \$40 million in funding available, with a maximum of \$10 million per project, to individual GHG reducing technologies from Canadian small and medium-sized enterprises that are deployable in Alberta.

Cumulative GHG Reductions by 2020: (Estimated Mt CO₂e as of February 2017)

Cleaner Energy Production and Processing	0.3
Renewable Energy	4.4
Biological	0.4
Energy Efficiency	2.4
<hr/>	
TOTAL	7.5

⁶ Market potential is calculated by ERA to estimate emission reductions that might be expected to occur under forecast market conditions. Considerations include policies and measures currently in place, and arising from the successful commercial adoption of technologies into Alberta, GHG emissions intensity, the estimated market size, various economic indicators and the lifespan of the technology.

Finally, in 2017 we will select recipients of funding under ERA's Methane Challenge. The climate change impact of methane is significant – twenty-five times greater than carbon dioxide over a 100-year period. The Alberta Climate Leadership Plan and Alberta's 2030 Innovation Targets aim to reduce methane emissions by 45 per cent by 2025. Launched in 2016, the Methane Challenge made up to \$40 million in funding available to develop technologies that address methane detection, methane quantification, or reduction of methane emissions in Alberta.

ERA projects have positive economic impacts, as well as environmental impacts, in Alberta and Canada. Seventy-six projects representing over 90 per cent of ERA's investment portfolio are Alberta-based. Sixty-two of ERA's projects, representing a total commitment of \$190 million, are led by small- and medium-sized enterprises.

ERA's investments also result in increased economic activity and employment. A 2017 study by Alberta's Department of Economic Development and Trade⁷ found that during the ten-year period from 2011 to 2021 ERA's investments in projects will support at least \$200 million in salaries and benefits, \$500 million in capital spending, and an additional \$1.1 billion in sub-contracting costs, which will include further capital and operational spending.

During this same ten-year period, ERA projects are expected to result in direct economic benefits to Alberta of approximately 4,000 person-year jobs and \$485 million of GDP growth. The total economic impact of ERA investment, including indirect and induced impacts,⁸ is estimated to be an increase of approximately \$1.8 billion to Alberta's GDP, with more than 15,000 person-year jobs added over the same period.⁹

ERA AND RELATED INVESTMENTS - IMPACT ON GDP AND JOBS, ALBERTA AND CANADA

	Direct Alberta	Total Alberta	Total Canada
GDP (\$ millions)	\$485	\$1,770	\$2,314
Jobs (person-years)	4,000	15,500	21,900

Source: Alberta Department of Economic Development and Trade modeling using Statistics Canada Input-Output Model

⁷ Using Statistics Canada's input-output model.

⁸ Direct impacts are those directly from the projects; indirect impacts come from the demand created by project investment; induced impacts are residual impacts to the economy.

⁹ Provincial GDP increase is less than total investment. Although projects may be located in Alberta, some goods and services are provided to Alberta-based projects by other provinces, resulting in spillover effects.

2.3 We Are Part of a Larger Plan

2.3.1 Supporting Alberta's Climate Leadership

Alberta's Climate Leadership Plan represents important progress for Alberta, and is an example of meaningful action by the province in support of Canada's obligation to meet GHG reduction targets. It is aligned with GHG mitigation priorities for Canada and with international agreements, and provides a mix of policy tools with the potential to deliver significant GHG reductions. Alberta's price on carbon is a critical tool for driving such reductions, and the carbon price paid by large final emitters is the source for ERA's funding.

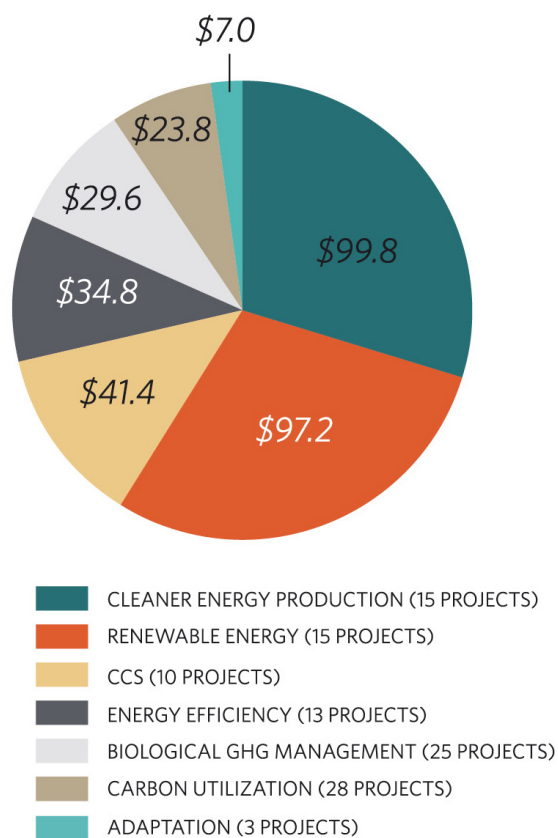
Meeting global targets will require ambitious and comprehensive programs of GHG mitigation options not just for Alberta, but for Canada and globally. Realizing these ambitious targets will require focused alignment around common priorities. ERA has worked with government, industry and stakeholders to develop a Technology Roadmap that will not only guide ERA's investments, but will also help align the system around common research and innovation priorities in support of the Climate Leadership Plan.

While our investment portfolio was originally designed to reflect the priorities identified in Alberta's 2008 Climate Change Strategy, ERA's investments remain strongly aligned with the priorities of the government's 2016 Climate Leadership Plan.

ERA's portfolio includes projects that address Climate Leadership Plan priorities including the 100 megatonne oil sands emissions cap, reducing methane emissions, phasing out coal-fired electricity generation, and increasing deployment of renewable energy. For example, ERA has committed nearly \$100 million to renewable energy projects with a total value of almost \$900 million. ERA has also committed more than \$71 million to support projects to accelerate emissions reductions from in situ oil production and an additional \$29 million to address emissions from oil and natural gas extraction.

The key to Alberta's economic wellbeing does not lie within the energy industry alone. ERA's portfolio touches all industry sectors, including opportunities to reduce emission from biological sources. We are currently supporting 25 biological projects with a commitment of nearly \$30 million, in areas like forestry and agriculture.

ERA INVESTMENT BY STRATEGIC AREA
(\$ MILLIONS)



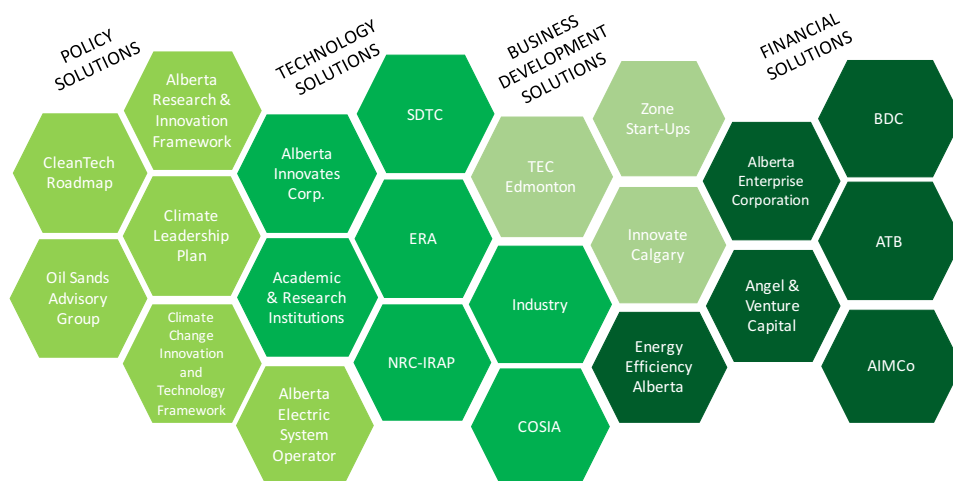
2.3.2 Aligning with Alberta's Innovation System

Alberta's innovation system is home to multiple government and private agents, service providers, and academic institutions that assist the government in its work to achieve its climate change objectives, while also supporting innovators and entrepreneurs.

Alberta offers a continuum of support organizations intended to allow innovators, entrepreneurs, small businesses, and large industry alike to move forward with new technologies to meet global challenges.

The system is growing and evolving and includes a broad spectrum of organizations and initiatives with climate change emerging as a key priority.

ALBERTA'S INNOVATION ECOSYSTEM



Note: This is not an exhaustive list.

At one end of the spectrum, Alberta's innovation system includes those seeking policy options, including government departments like the Alberta Climate Change Office, Alberta Economic Development and Trade, and Alberta Energy. It also includes policy instruments such as the Climate Leadership Plan, the work done by the Climate Technology Task Force, and the advice provided by the Oil Sands Advisory Group.

At the other end, it includes organizations like TEC Edmonton and Innovate Calgary, who provide the business development supports that help move technologies towards commercialization. This also involves groups that provide financial solutions such as Alberta Treasury Branch (ATB), the Business Development Bank of Canada (BDC), and angel and venture capital organizations.

Finally, it includes groups that focus on technology development, like ERA, SDTC, Alberta Innovates, post-secondary and research organizations, and industry.

Organizations across Alberta's innovation system need to work together to scale-up the most promising solutions. To do so, the system needs clear and focused strategic outcomes, so all players can align their efforts. Alberta has the pieces in place; now we need them aligned and working together to create the seamless handoffs required for success.

To support this alignment, the province is developing a suite of Innovation Targets to achieve by 2030. The targets are intended to be realistic and measurable, while inspiring collective action to develop transformational solutions that advance our desired outcomes. These aspirational, yet feasible targets, established in Alberta's areas of strength and emerging opportunities, are intended to help the province:

- Stimulate bold ideas and actions from innovators, industry and entrepreneurs;
- Guide research investment to support new knowledge where it's needed; and
- Support a robust pipeline of innovations from early stage, to scale-up, to market-ready.

ERA's path forward is clear. Our Technology Roadmap will help chart the course towards shared climate change and innovation goals that result in meaningful GHG reductions in Alberta.

Alberta's 2030 Innovation Targets

The Government of Alberta is setting aspirational, yet achievable innovation targets to achieve by 2030. These include:

Grow Alberta's Green Economy

Support the cleantech sector to increase industry sales revenue by 25%, thereby increasing Alberta's global market share by 20%

Reduce GHG Emissions

Support Alberta's climate change goals by accelerating solutions to reduce methane emissions by 45% by 2025 and ensure a dynamic portfolio of GHG emission reduction technologies (2014 base)

Increase Value & Market Access

Support the successful commercialization of new value-added products to increase the market value of Alberta's oil and gas exports by 25% and expanding access to market

Improve Oil Sands Efficiency

Oil sands production efficiency and economics improve by decreasing fresh water use by 50%, GHG emissions by 50% on a per barrel basis, and supply cost of bitumen to be globally competitive

Renewable Energy

Renewable sources, like wind and solar, will contribute 30% of Alberta's electricity generation.

Drive Bioindustrial Investment

Industry operating in the value-added bioindustrial sector will attract an additional \$3 billion private sector investment in Alberta

3.0 STRATEGIC CONTEXT – THE CHALLENGE

3.1 The Technology Imperative

Without a doubt, meeting the world's growing energy demand while reducing GHG emissions requires innovation and transformative technologies. Incremental improvements and energy efficiency gains that allow us to do the same things better are essential, especially in the short-term, but they alone will not get us where we need to go. Deployment of next generation technologies is a critical component of a global solution to address climate change in the long term.

3.1.1 Achieving GHG Reductions in Multiple Timeframes

The technology imperative makes it clear that addressing climate change requires investment across multiple timescales – both near and long term.

There are “off-the-shelf” solutions available today that can contribute to reducing GHG emissions in the near future, as well as solutions that need a financial “push” to move to commercialization. These economically attractive options like energy efficiency can help, but these alone will not produce the GHG reductions that are required to meet the commitments set out in the United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement.

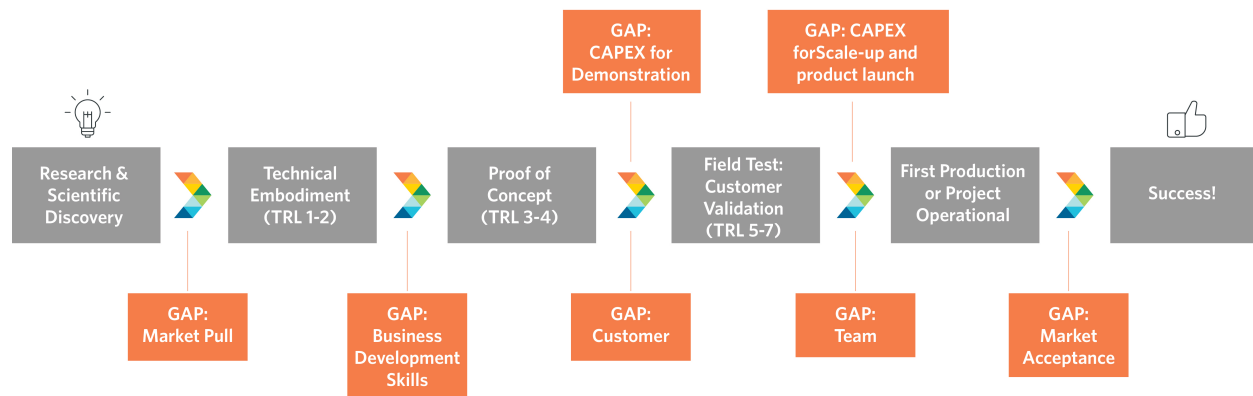
It is a tremendous challenge that will require accelerating development of game-changing technologies. Long-term reductions require focused and sustained investment in breakthrough solutions, or the “10X improvements.” Advancing such potentially game-changing technologies is risky, but offers the potential for much greater emissions reductions.

3.2 Critical Innovation System Gaps

Today, innovators face significant and numerous system gaps that hinder technologies from scaling up so they can be adopted by industry. Public funding alone will not accelerate these new technologies to commercialization. Addressing these gaps requires an all-hands-on-deck approach, with government and industry sitting at the same table.

3.2.1 Market Pull and Policy Push

INNOVATION SYSTEM GAPS



In order for a new technology to advance to commercialization, it must provide a solution that industry needs. Policy and regulation, such as carbon pricing and performance standards, can create incentives for industry to seek out opportunities to improve operations, reduce costs and find efficiencies.

Alberta needs to consider both market pull and policy push in determining its technology investments. To be effective, we should invest in solutions that tackle the problems Alberta must solve today, while also seeking out transformative technologies to address Alberta's largest GHG sources over the longer term.

3.2.2 Business Development and Competency Gaps

Even with a strong demand for a solution from the market, deployment of a new technology requires a successful business model. Furthermore, business models must identify a first customer for the solution – ideally someone who is willing to partner to demonstrate or validate the technology.

An idea also needs the right team assembled around it – one that can begin to consider supply chain management, manufacturing, sales, and that can take the technology into product commercialization.

3.2.3 Lack of Scale-Up Capital

Solutions to address the climate change challenge require investments of significant scale and magnitude. In 2015, the International Energy Agency (IEA) estimated that \$13.5 trillion in capital will be required between now and the year 2030 to fund commitments made under the Paris climate agreement.

Countries are investing billions of dollars in climate change innovation, and Alberta's emissions and energy challenges require a scale of investment that is commensurate with its climate leadership ambitions. Furthermore, clean energy technologies in particular require significant capital investment to develop and commercialize. High potential innovations have been left on the table because there are insufficient funds for investment.

Lack of capital investment for demonstration, scale-up, and product launch can impede development, since the ultimate customers for a technology are often unwilling to take on the risk inherent in these stages, and development companies are typically not yet able to access traditional bank financing.

Directing public money to demonstration projects can help to de-risk private sector investment and ERA funding has helped advance promising technologies in Alberta. However, some of these technologies are now at a development stage where significant capital is still required before private financial institutions will invest. While these may be promising technologies, they are struggling to access the level of large patient capital that is required to move to commercialization.

3.3 Aligning Efforts Through a Complete Solutions Approach

ERA's mandate is to invest in technology solutions, but this is not our sole focus. Although funding is part of the solution, creating partial solutions will not result in success. Success will require smart financing and strong business models, and creating an effective and efficient environment where good policies and strong regulatory frameworks enable us to deliver results.

To support economic diversification, job creation, education, training and climate change action, ERA will work in close alignment with the evolving Alberta innovation system. We will do our part to create complete solutions, including the suite of policy, regulatory, program, and business innovation tools required to address system gaps and deploy new technologies. By putting these conditions for success in place, we will make it clear to investors and inventors, and all the players in between, that Alberta is a place to turn ideas into products, and products into companies.

Going forward, ERA will play a role not only as a funder, but also in providing mentorship, engaging in complementary strategies being developed by government, and collaborating with organizations that promote innovation in Alberta and across Canada, including Alberta Innovates, Ontario Centres of Excellence (OCE) and SDTC.

The private sector is also stepping up through unique models like Canada's Oil Sands Innovation Alliance (COSIA), a collaborative alliance of oil sands producers working to improve environmental performance. Large emitters are ERA's partners in the system, too, investing in innovation and choosing to pay into the Climate Change and Emissions Management Fund that funds our operations.

4.0 ERA: SUCCESSFULLY ACCELERATING INNOVATION

Innovation and technology are critical to delivering on Alberta's desired climate change outcomes and priorities. ERA is putting the right delivery mechanisms in place to play a key role in achieving success. These include a balanced portfolio, an efficient and effective business model, clear and focused priorities for our investment and operations, robust performance metrics, and stable, predictable funding.

The sections that follow describe the initiatives and actions required to deliver on our mandate, while our \$100 million budget (Section 7.0) gives us the means to effectively execute on this Business Plan.

4.1 Technology Roadmap¹⁰

As part of engaging in more active management of its portfolio, ERA has developed a Technology Roadmap to help guide its investment decisions and inform its portfolio mix. It is designed to assist ERA in addressing the critical system challenges and gaps highlighted in Section 3.0 of this Business Plan by ensuring ERA's investments are achieving GHG reductions in multiple timeframes; providing solutions the market needs; building on Alberta's existing strengths and creating new opportunities; and building on guidance from Alberta's climate and innovation system.

The Roadmap defines potential innovation and technology pathways for achieving desired climate change policy outcomes, maps the tactical options and initiatives to deliver needed solutions for each pathway, and identifies potential high impact technology investments that can help demonstrate Alberta's climate change leadership. It also provides advice regarding specific responsibilities and accountabilities of players in the innovation system.

The Roadmap can help align the broader innovation system to deliver meaningful GHG reductions in Alberta. If successful, the Roadmap will assist the innovation system in focusing on common climate change and innovation goals, technology pathways and priorities, and defined implementation timeframes.

4.1.1 ERA Technology Roadmap Investment Areas of Focus

ERA has identified four areas of focus as a result of its work to-date on developing the Roadmap:

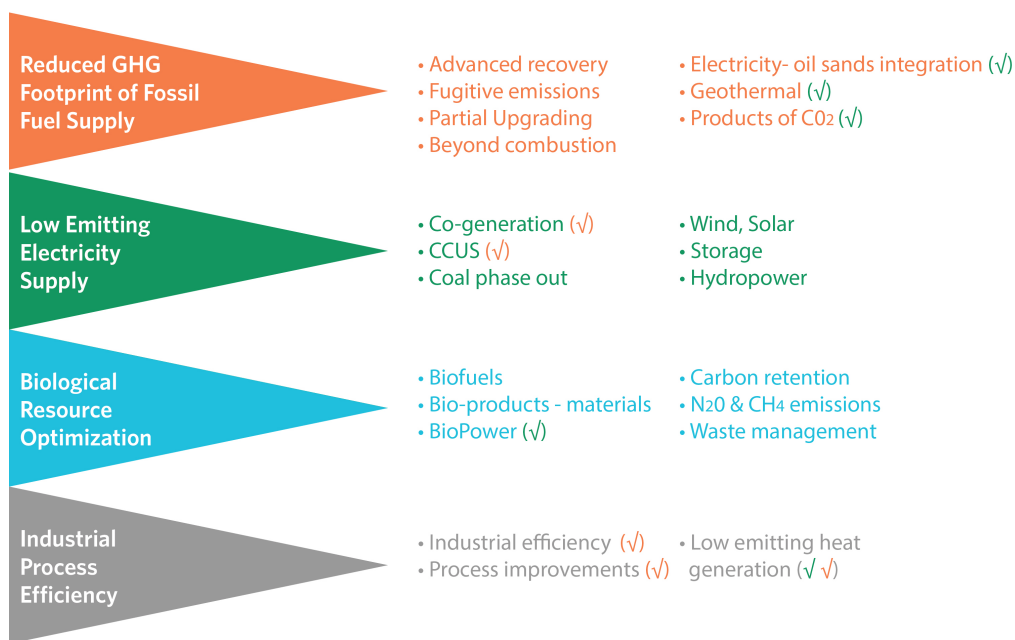
1. Transformative technologies and innovation to reduce the GHG footprint of the fossil fuel supply chain and reduce methane emissions while reducing production costs;

¹⁰ ERA's Technology Roadmap is available on the ERA website at ERAAlberta.ca

2. Technology and innovation to reduce the GHG footprint of Alberta's electricity supply mix and add more non-emitting supply to meet overall demand;
3. Innovation and early stage technologies for biological resource optimization in supporting energy system transformation, such as biofuels/bioproducts and carbon retention opportunities; and
4. Industrial process efficiency technologies to deliver GHG reductions through opportunities such as energy conservation and energy efficiency.

AREAS OF FOCUS

POTENTIAL INITIATIVES



Check marks indicate where potential initiatives apply under more than one area of focus.

The unprecedented pace of technological change, as well as the breadth and the depth of many radical changes unleashed by both the new digital age and energy production technologies (such as fracking), represent major uncertainties for the direction of innovation. At the same time, global and Canadian climate policies remain uncertain, could evolve rapidly and will likely become even greater drivers for technological innovation and change.

ERA's Technology Roadmap should be viewed as a living document, and part of a continuous process designed to support a flexible and nimble organization that can adjust to new information, new challenges and new opportunities.

Furthermore, the process for decision making on the GHG mitigation options and how mitigation programs can be implemented is complex. While the Roadmap will be used first and foremost to guide ERA investment decisions, we will continue to engage broadly with government and stakeholders to seek advice and validate the priorities and directions of the Roadmap.

4.2 Strategic Initiatives and Partnerships

Partnerships are central to success, and ERA is working collaboratively with government, industry and other stakeholders to secure a lower carbon future for Alberta. Partnerships enable us to leverage funds, share risk, and accelerate technology development. They are especially important in the Alberta context where advancing energy technologies can cost hundreds of millions of dollars.

Partnerships provide an opportunity to align around outcomes, challenges and directed innovation opportunities. Partnerships can also limit duplication of lengthy due diligence processes and shorten funding timelines for promising technologies. And they help to convene and close the gaps on technological, business development, financial resources, and capacity.

Our recent collaborative efforts include a call for proposals offered in partnership with SDTC, as well as working with COSIA to jointly advance critical CO₂ conversion technologies through the ERA Grand Challenge and the NRG COSIA XPRIZE.

Our ongoing relationship with the newly consolidated Alberta Innovates is critical to achieving our strategic and operational goals. More importantly, the partnership provides the innovators and technologies we fund with a simplified means for accessing our resources and supports.

We have learned a great deal through collaboration, and partnerships will continue to play an important role in accelerating technology development in the years ahead. We will seek to further existing partnerships with organizations like SDTC, COSIA, and OCE, as well as look to develop new collaborative relationships with academic and research institutions, federal organizations such as Natural Resources Canada (NRCan), and financial institutions like Alberta Treasury Branch (ATB), who are exploring opportunities for clean technology investment and green financing.

We are also exploring new ways of doing business that will allow us to better leverage our partnerships towards shared outcomes. The following pilots are being launched to assess how they contribute to accelerating innovation and more rapidly move ideas to commercialization in Alberta.

4.2.1 Partnership Intake Pilot

ERA will continue to use a competitive process to select projects through its core funding program, generally inviting submissions twice a year. This involves a rigorous due diligence process to select projects for funding that are most aligned with our mandate and the investment priorities identified in our Technology Roadmap. The call for proposals process is an effective and efficient process for evaluating multiple opportunities and for comparing the relative merits of different opportunities side-by-side.

However, the scope and timing of ERA's calls for proposals process has resulted in some challenges and missed opportunities. Examples include:

- Projects that receive funding from ERA and one or more partnering organizations often undergo multiple lengthy, and sometimes duplicative due diligence processes;
- ERA is sometimes presented with strong opportunities through partnering organizations, such as Alberta Innovates, but is unable to evaluate these opportunities in a timely manner because the next call for proposals is not open or is not aligned by focus area; and
- ERA often evaluates proposals that are strong, but contain weaknesses that result in a recommendation not to fund. If applicants are able to address their weaknesses, they may not have a timely opportunity to re-enter into the ERA funding process.

To address these challenges and develop greater flexibility, ERA is undertaking a process on a trial basis that allows proposals from “trusted partners” to be evaluated and considered for funding in an ongoing manner.

Through the Partnership Intake Pilot, ERA will develop a formal definition and criteria for its trusted partners. In general, a trusted partner will include funding organizations with rigorous, fair and transparent due diligence processes comparable in principle to ERA’s, including elements such as peer review and technical expertise. This could include provincial organizations and funders such as Alberta Innovates and OCE; federal entities like SDTC and NRCan; research and polytechnic institutions; and industry, financial institutions and private funders whose investment priorities are aligned with ERA’s mandate and desired outcomes.

The Pilot will provide credible technology developers more timely access to ERA funding; allow ERA to leverage our trusted partners’ due diligence processes; and allow ERA to develop capacity and processes for evaluating applications on an ongoing basis. The Pilot will also help inform the benefits and resource requirements for consideration of a continuous intake model in the future.

ERA will run this Pilot for one year, at which time it will review the outcomes and learnings and decide on next steps.

4.2.2 Innovator Support Pilot

The innovation system in Canada and Alberta is complex, but rich in resources and capacity. ERA is uniquely positioned to leverage and convene capacity in the system to foster the commercialization of innovative technologies, over and above the funding and technical expertise it brings to the table.

When projects are selected and contracted for funding, it is common practice for ERA to assign a project advisor to help steward the project in accordance with its funding agreement. Furthermore, ERA has worked with select funded or contracted projects to address business, financial or technological readiness challenges with some success.

ERA has also begun to explicitly incorporate commercial potential criteria for each project into the funding applications and contribution agreements. To enhance this perspective, ERA has engaged IC.TEC, a collaborative relationship between Alberta incubators Innovate Calgary and TEC Edmonton. IC.TEC is jointly supporting ERA proponents alongside Alberta Innovates, and participating in the upfront project review process to select recipients of ERA funding.

ERA has also worked with IC.TEC to develop a web-based series of educational modules. The series is focused on providing broad awareness to entrepreneurs about business topics that are necessary from the idea stage, entering the market, through expanding the market. The modules are being piloted with ERA's Grand Challenge and Methane Challenge funding recipients, and we are working with government departments to determine how this material could be leveraged for the further benefit of the innovation system in Alberta and, if desired, across Canada.

Given the success of these efforts, ERA sees an opportunity to explore additional proponent support for the benefit of unfunded projects or technologies. Together with SDTC, ERA is jointly piloting a more structured process for growing the support capacity to assist promising projects and technologies. A number of unfunded but promising technologies identified under the joint ERA-SDTC funding call offer an opportunity to pilot such a process. This "SWAT team" capacity would leverage the knowledge of existing entities and experts in the innovation ecosystem, with ERA and SDTC providing a triage and connecting function to help identify and bring together the appropriate resources needed for success.

This Innovator Support Pilot will target projects or technologies that show promise but do not yet qualify for funding due to specific challenges. The SWAT team model affords ERA and SDTC the opportunity to identify at an early stage potential barriers to commercialization and flag the resources required to overcome these barriers. Initiating this process prior to funding would allow barriers to be identified and addressed before entering into a contribution agreement, leading to more successful funded projects and fewer stranded grants. This SWAT team approach would also allow projects to be on-ramped for funding more quickly once specific barriers are addressed, since the bulk of the due diligence would have already been completed.

An important element of such a program will be to develop the criteria to determine what constitutes a "promising" project or technology that merits additional time and resources. It will also be important to determine through the Pilot what costs ERA is prepared to bear in providing proponent support; what internal resources we are prepared to dedicate to this effort; what period of time we are willing to dedicate, required financial and staff resources; and how we can maximize existing external financial and human capital resources in the system.

4.3 Future Funding Opportunities

ERA invests in innovative technologies that reduce GHGs, align with the outcomes of the Climate Leadership Plan, and provide solutions the market needs. This investment will be made available primarily through the delivery of two funding opportunities per year averaging \$40 million each. These calls for proposals will be augmented by \$15 million we will invest under our Partnership Intake Pilot (section 4.2.1).

ERA's Technology Roadmap (section 4.1) provides us with areas of focus for investment and guideposts to help shape our portfolio. Based on the policy direction provided by the Climate Leadership Plan, and the priorities and guideposts laid out in the Roadmap, there are four potential funding areas that ERA is exploring for its future funding opportunities.

4.3.1 Technologies to Help Meet the 100 Megatonne Per Year GHG Emissions Limit for the Oil Sands

Alberta's oil sands sector accounts for about one-quarter of Alberta's annual emissions, emitting roughly 70 megatonnes per year. The Alberta government is implementing measures intended to create conditions for the oil sands sector to innovate and become more globally competitive. These include transitioning to an oil sands-based performance standard for the \$30/tonne carbon price and legislating a 100 megatonne overall limit to oil sands GHG emissions.

The limit is intended to help drive technological progress, ensure Alberta's operators have the necessary time to develop and implement new technology that reduces emissions intensity, help bend Alberta's overall emissions trajectory downward, and support continued economic growth through increased production. If we are not able to effectively reduce the GHG footprint of the oil sands, Alberta may lose future revenues and continue to struggle with issues like market access and social license.

Industry has recognized the need for solutions to address this critical challenge. GHGs represent one of the four key Environmental Priority Areas (EPAs) identified by COSIA. Through this collaborative industry organization representing approximately 90 per cent of oil sands production, member companies are investigating ways to reduce energy use and associated GHG emissions through the development of innovative technologies for oil sands in situ and mining operations.

Industry players are also jointly funding Evok Innovations, a cleantech fund that accelerates the development and commercialization of solutions to the most pressing environmental and economic challenges facing the oil and gas sector today. Among their goals is to achieve net-zero carbon emissions across the entire oil and gas value chain.

Government also recognizes that continuing to grow our economy depends on applying technology to reduce our carbon output per barrel. In 2016, the province established an Oil Sands Advisory Group (OSAG) composed of members from industry, environmental organizations and Indigenous and non-Indigenous communities to provide advice on the oil

sands aspects of the Climate Leadership Plan. The OSAG mandate includes considering how to implement the 100 megatonne per year carbon emissions limit and providing advice to government on investing carbon revenues in innovations to reduce future emissions intensity.

ERA needs to work with both industry and the OSAG to advance this potential funding opportunity area in alignment with government outcomes and priorities. In early 2017, ERA hosted a workshop to increase understanding and alignment with the OSAG, and to garner input into ERA's Technology Roadmap in the context of the oil sands sector. The discussion included a spectrum of stakeholders including oil sands companies, industry associations and non-governmental organizations, provincial and federal government departments and agencies, academia, technology incubators and accelerators, and investors.

Key emerging themes of the workshop centered largely on the need to balance seemingly competing principles when considering innovation and investment priorities for this sector. For example, ERA should seek opportunities to:

- Support resiliency of existing infrastructure AND growth opportunities for new facilities;
- Address industrial greenhouse gases AND grow the economy; and
- Invest in "big bets" AND develop a diversified portfolio.

These and other discussions have revealed several promising technology families and options to help address this challenge in the oil sands. For example, technologies that can reduce or eliminate the need for water for situ development are widely viewed as essential to reducing GHG emissions in the oil sands, including solvent technologies and others that use solvents with electromagnetic heating.

However, as with many clean technologies under development, a critical challenge facing innovation in the oil sands is securing capital for late stage technology demonstration and first use deployment. Table 1 provides a framework for potential technology themes that ERA could support under this funding opportunity.

Table 1. Potential Oil Sands Technology Themes

	Mining Operations Technology Themes	In Situ Operations Technology Themes
Large Step-Change Improvements of Established Technology Platforms and Infrastructure (Brownfield)	Reduce GHG emissions from Tailings ponds Carbon Capture and (Utilization or Conversion)	Improved efficiency in delivery, utilization, and recovery of steam, e.g., - Solvent enhanced SAGD - Non-condensable gas injection
New Technology Paradigms (Major Expansions & Greenfield Applications)	Non-aqueous bitumen extraction technologies	Carbon Capture and (Utilization or Conversion) Non-steam based technologies, e.g., - Solvent-based recovery - Electric &/or radiofrequency heating

4.3.2 Technologies to Optimize Biological Resources

Innovative technologies for biological GHG emissions management offer important investment opportunities for ERA. Agriculture, forestry and municipal waste management result in the release of biological-source GHGs of approximately 25 megatonnes annually, and methane from livestock digestion and manure, nitrous oxide from fertilizer and crop residue, methane from landfill gas and biosolids, and carbon dioxide from the use of fossil fuels and liming all offer opportunities for reduction, as do forest industry and waste management emissions.

The use of biological processes and products to replace fossil carbons or “biocleantech” also holds significant promise to reduce emissions from other sectors. Areas of opportunity for Alberta include using agricultural and forest residues and municipal wastes to produce renewable natural gas; biomass co-generation for district heat and power and industrial process heat (oil sands in situ for example); biofuels for the transportation fleet; substitution of coal for electrical energy, cement and lime production; and biocrude upgrading.

Unlike other industrial sectors, biological industries share a few unique attributes. Since many agricultural, forestry and municipal emissions sources are below Alberta’s regulatory threshold, emission measurement, monitoring and reduction have not become part of the core business for these sectors. Furthermore, economic incentives for emissions control are relatively small. In addition, both activities and emissions are generally more dispersed, so management strategies as well as technology development are unique and critically important.

Biological sectors also offer opportunities to reduce emissions through carbon retention. The land can act as a sink, sequestering emitted anthropogenic carbon through practices like avoided deforestation, afforestation, and “negative emissions” technologies such as bioenergy with carbon capture. Technologies to help accurately measure and assess biological carbon retention and sequestration will be important for capitalizing on these opportunities.

Through ERA’s assessment of its Biological GHG Management Program (section 4.4.2), several key areas for technology investment were identified. Technologies that monitor, collect, aggregate and analyze spatially explicit emissions data are essential for improved GHG management in land, forestry and agriculture. Further, such technologies are critical to a complete solutions approach for this sector that will support business development, policy creation, provincial reporting, and development of regulations and incentives relating to biological systems.

Customized technologies for existing Alberta applications represent another important opportunity for investment. Adoption of biomass-based technology is often hampered by the inability to integrate new technologies with existing infrastructure. Technologies that facilitate use of biogenic carbons will inherently reduce emissions while generating new, high-quality jobs. An example of this approach includes the development and testing of biomass conversion units that can reduce the need to move bulky forest residues long distances for conversion to heat and power.

Finally, advanced technology demonstrations are critical to furthering innovation in the biological sectors. As with many sectors, aversion to technology risk represents a barrier to adoption of technologies in Alberta's biocleantech sector, and support is required to advance both the technology and the business model to commercial scale. Capital requirements for demonstration plants are high, but success offers opportunities to reduce GHGs while increasing economic development and employment.

4.3.3 Technologies to Support the Phase-out of Coal and Increase Non-emitting Electricity

The Climate Leadership Plan commits to putting an end to coal-fired power emissions and transitioning to cleaner sources of electricity. Under the Plan, coal-fired electricity generation will be phased-out by 2030. The Plan also sets a "30 by '30" renewable energy target, in which 30 per cent of electricity used by Albertans will come from renewable sources like solar, wind and hydro by 2030.

In partnership with the electricity sector, ERA can help accelerate and de-risk technologies to transition away from coal. Opportunities exist for innovative technologies to support Alberta's climate goals, including new ways of harnessing non-emitting fuels, development of energy storage and distributed energy technologies, and technologies that generate energy from biological resources or geothermal fuel sources.

While this represents an important potential funding area for ERA, work is still underway by Government to create the strong and stable policy and regulatory environment required to support this opportunity. The province is working to implement the advice provided by Alberta's coal facilitator regarding the coal phase-out, and programs to accelerate deployment of renewable energy are still being developed, including the competitive and transparent bidding process that will be implemented under the Renewable Electricity Program.

ERA will work closely with government, the Alberta Electric System Operator (AESO), and industry in the coming months to understand the specific opportunities to accelerate innovation that can respond to the policy and regulatory signals to phase-out coal-fired electricity generation, increase renewable energy, and address the technology needs of the market.

4.3.4 Technologies to Encourage Industrial Process Efficiency

Energy and industrial process efficiency improvements are recognized as an effective way to reduce GHG emissions, while reducing costs for industry and saving consumers money. ERA has supported a number of technologies that improve industrial process and energy efficiency. They include, as examples, demonstrating Combined Heat and Power units in commercial and institutional buildings and demonstrating a high-efficiency evaporator system at a pulp mill. In 2015, ERA issued a call for projects that could deliver significant and sustainable near-term GHG reductions in Alberta, which included several industrial energy efficiency projects.

Ultimately, the call was cancelled in order to ensure that investments in this area were aligned with ERA's mandate and the policy direction of the Climate Leadership Plan.

The Government of Alberta has committed to supporting energy efficiency and community energy system programs to help reduce energy use and associated costs, reduce GHG emissions, and support green jobs for families, businesses, industries, municipalities, and others. Under the Climate Leadership Plan the government has announced the establishment of Energy Efficiency Alberta, a new provincial agency that will deliver a variety of programs and services for energy efficiency and small-scale renewables.

In 2016, the Government established the Energy Efficiency Advisory Panel to make recommendations on the types of energy savings programs that Energy Efficiency Alberta will deliver in the short and medium-term, as well as help set out its long-term vision. The Panel's report to government included a number of recommendations related to innovation. As part of the long-term vision, the report suggests that the work of the Agency should help Albertans "embrace energy efficiency and readily access new energy-saving technologies, whether at home, school or work." It also recommends that the Agency be formally represented and linked to government innovation structures and initiatives, and that "contribution to innovation" be used as a potential criterion for certain programming of the Agency.

Accelerating technologies and investing in innovative projects that improve energy and process efficiency are important mechanisms for industry to cut both costs and carbon. This helps improve competitiveness on both the price and emissions profile of energy products, and is a critical part of increasing the resiliency and efficiency of our existing infrastructure.

Investment in this area often involves supporting processes and technologies that allow us to do what we already do, but better. From a timescale perspective, this generally means delivery of nearer-term reductions through investment in scale-up of later-stage technologies that are closer to "shovel-ready", as compared to riskier, game-changing technologies that could achieve deeper, but more long-term reductions. As a result, the barriers to implementing industrial process and energy efficiency opportunities are often related to access to capital and financing challenges, rather than being strictly technological in nature.

As outlined in our Roadmap, technologies to improve industrial process efficiency should continue to be a part of ERA's project portfolio, through both our call for proposal model and our Partnership Intake Pilot. Given the capital-intensive nature of industrial process and energy efficiency projects, we will rely on our well established and rigorous evaluation process and requirement that ERA funds be matched by private investment to ensure we are supporting the right projects and making the most efficient and effective use of our funds. ERA will also need to work closely with Energy Efficiency Alberta to ensure we are playing a complementary role in supporting this opportunity area going forward.

The risks associated with not adopting these important technologies are significant. In addition to reducing GHG emissions, adoption of efficient technologies is necessary to close a growing productivity gap with our major competitors.¹¹ The IEA has estimated that 70 per cent of potential energy savings in Canada's industrial sector remains untapped for existing energy efficient technologies. If Alberta is not able to enhance industrial energy efficiency, it will impact the ability of the province's largest industries to compete in the global marketplace.

¹¹ https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/www/pdf/publications/emmc/15-0138_Industrial%20report_e_acc.pdf

4.4 Ongoing Operational Improvements

4.4.1 Business Delivery Model Assessment

ERA is currently assessing its business delivery model to ensure the organization can address its business needs efficiently and effectively and in a way that is aligned with Alberta's Climate Leadership Plan, addresses market pull, and ensures promising technologies can be accelerated from ideation to commercialization through Alberta's innovation system.

Since we were established in 2009, ERA's business needs have been carried out by a network of outstanding service providers and delivery partners contracted to carry out specific functions. However, every good business delivery model requires review and assessment to ensure it is providing the best possible value. This assessment aims to ensure accountability to stakeholders and that ERA is operating as efficiently, effectively and transparently as possible. As part of the work, ERA is transitioning to an organization with an increased number of staffed roles, supported by external services providers.

Work to assess the delivery model is being supported by outside expertise and will include a review of ERA's functional work areas and organizational structure, current business delivery methods and processes, and external service provider agreements.

4.4.2 Biological Program Assessment

As part of the business delivery model assessment, and in an effort to further flesh out the priority areas of the Technology Roadmap, ERA undertook an assessment of its Biological GHG Management Program.

Optimizing biological resources is a priority area for ERA going forward, as identified in the Roadmap. However, the current Biological GHG Management Program is funded by ERA but hosted by Alberta Innovates, and has features that make it unique from other aspects of ERA business. The assessment reviewed the Program's outcomes, successes, and lessons learned since its inception, and will serve to develop an approach that will support Alberta Innovates and ERA delivering on the biological priority area in an integrated fashion over the long term.

The assessment will inform ERA's funding opportunity areas going forward (see section 4.3.2) and will serve to further Alberta Innovates and ERA's partnership and integrated approach to investment in biological GHG management opportunities. As a result of this work, management anticipates the following changes to how we deliver on this priority:

- A smaller number of focused investment priorities within the biological opportunity space;
- Clearer role delineation, hand-offs and accountability among Alberta Innovates and ERA, enabling delivery on this priority area in a more integrated fashion over the long-term;

- A delivery model more aligned in process, transparency and due diligence with other ERA priority areas of the Technology Roadmap (e.g., traditional call for proposals), with the Partnership Intake and Innovator Support Pilots providing opportunities to address challenges unique to biological sectors;
- Trusted partnerships established with smaller organizations that demonstrate a shared interest and expertise in ERA's identified investment priorities; and
- Continued leverage of the expertise convened under the program's Expert Advisory Committee (EAC) through review teams and future hosted workshops to advance Roadmap priority areas.

5.0 STRATEGIC PRIORITIES

Alberta has articulated its strategic climate change desired outcomes and priorities through the Climate Leadership Plan. Innovation and technology will play a critical role. ERA has heard from key players in the innovation system that there are important challenges and areas for innovation success that must be addressed to deliver on those outcomes. Through the four strategic priorities and associated outputs and activities outlined below, ERA is demonstrating how it fits within the Alberta innovation system, and how it will play a key role in achieving success. Our \$100 million budget (section 7.0) gives us the means to carry out these priorities.

5.1 Strategic Priority #1: Accelerate GHG Reducing Technologies

Fund innovative solutions that result in meaningful GHG emissions reductions in Alberta and contribute to a lower carbon world.

What we plan to do

Rigorously select projects that facilitate GHG emission reductions and represent best-value for investment

- Invest in both open and directed innovation opportunities that reduce GHG emissions.

Strategically align portfolio investments with GOA priorities

- Invest in innovation that aligns with the Climate Leadership Plan and other related Government of Alberta policies.

Engage with key stakeholders to understand and be responsive to Alberta Climate Leadership Plan policies as well as market demands

- Active and deliberate management of the ERA portfolio by the Board and management is informed by ongoing engagement with government, industry and innovators.

What we plan to deliver

Innovative projects focused on reducing GHG emissions or address identified market needs in Alberta

- Fund and identify innovative technology solutions through a minimum of two funding calls per year (average \$40 million each) and under the Partnership Intake Pilot (\$15 million) focused in areas that align with the Technology Roadmap.

Investments informed by ERA's Technology Roadmap

- ERA's investment decisions are guided by a Technology Roadmap that takes into account both "policy push" from government and "market pull" from industry.
- Invest in projects that align with Roadmap strategic focus areas and initiatives.

ESEIEH

ERA has invested in technologies that could significantly reduce the carbon footprint of the oil sands. Our Enhanced Solvent Extraction Incorporating Electromagnetic Heating project, or ESEIEH ("easy") is a clear example of innovation and collaboration, led by a consortium of oil sands companies working with Harris Corporation. While this project will not produce GHG reductions by 2020, the technology has the potential to be a game-changer in the oil sands, and could significantly reduce the carbon footprint of the oil sands industry if it can be proven and deployed.

Quantitative sectoral GHG emissions analysis

- Ongoing quantitative sectoral GHG emissions analysis to inform ERA investment portfolio mix and the outcomes of the Climate Leadership Plan.

Host workshops, conferences and board events

- Host a major conference event every other year.
- Engage in targeted outreach, collaboration and workshops with government, industry, academia, and other key stakeholders to inform ERA's investment decisions and to help inform policy development.

What we seek to accomplish

Increase investment in Alberta-based projects that will contribute to reducing GHGs in Alberta and Canada

- Technological learnings and knowledge sharing to help accelerate commercial deployment of GHG reducing technologies.

Increase jobs in Alberta's clean technology sectors

- Measurable jobs (temporary and permanent), GDP creation in new sectors, and economic benefit (direct and indirect) created in Alberta from projects funded, in part, by ERA.

Increase investment in solutions that align with Alberta's Climate Leadership Plan needs, 2030 Innovation Targets, and Alberta's market demand

- Increase public and private sector investment in technologies that are demanded by the marketplace, diversify Alberta's economy and increase employment in the short and long term.

SBI Fine Chemicals

The SBI Fine Chemicals demonstration plant in Edmonton is an example of a bioenergy project ERA is supporting. SBI is developing a drop-in diesel fuel from non-food grade canola that is virtually indistinguishable from traditional diesel. SBI plans to sell the fuel to refineries to be mixed with other diesel products to help meet renewable fuel standards. Today, Alberta must import renewable fuel to meet these requirements. SBI has attracted international interest, but the company has struggled to raise money in Canada. We estimate the SBI project could reduce GHG emissions by more than 38,000 tonnes of carbon dioxide equivalent (CO₂e) by 2020.

Where we plan to have an impact

Eliminated coal-fired electricity generation emissions and increased renewable energy; reduced oil sands emissions; reduced methane emissions; and increased process efficiency

- Accelerate bold solutions that reduce GHG emissions in Alberta, Canada, and internationally.

Maintain Alberta's economic competitiveness

- Alberta achieves greater economic diversification through industries supported by the innovation system.
- Increase attraction of investment to Alberta.
- Enhance global reputation for Alberta and Canada as an effective steward of the environment.

What we plan to measure



GHG emissions reductions (project and market potential; portfolio and cumulative)



Investment (portfolio and cumulative; ERA and total project; by jurisdiction)



GDP impact (direct and total; by industry and jurisdiction)



Job creation (direct and total; by industry and jurisdiction)

5.2 Strategic Priority #2: Advance Innovation System Priorities

Leverage our strengths to contribute to critical climate change innovation priorities in Alberta.

What we plan to do

Maintain existing and establish new partnerships that maximize and leverage shared investment capacity and expertise; for example, Energy Efficiency Alberta, Alberta Innovates, COSIA and SDTC

- Develop shared value partnerships to raise the awareness of ERA's strengths and credibility as an organization that reduces GHG emissions and is contributing to a lower carbon world.

Facilitate strategic partnerships among projects and resource/knowledge suppliers

- Engage in targeted outreach, collaboration and communications to help educate key stakeholders and to inform policy development.

What we plan to deliver

Leverage investments

- Funding calls structured to leverage investment from our key partners (e.g., federal and provincial governments, municipalities, large emitters and other industry partners).

Strong strategic partnerships in Alberta, Canada, and internationally

- Strong strategic partnerships that accelerate technology development in Alberta and build ERA's reputation (e.g., provincial and federal entities, research and polytechnic institutions, financial institutions and private funders).

Knowledge and resource sharing to support clean technology

- Cross pollination of ideas, actions, and shared resources are the way of doing business between interconnected organizations.
- Collaborative resources available to and utilized by relevant entrepreneurs.

Joint SDTC-ERA Call for Proposals

In 2016, ERA and SDTC jointly launched a unique funding opportunity to Canadian clean technology innovators and entrepreneurs that addressed the interests of both organizations. Together, we made funding available for individual GHG reducing technologies from Canadian small and medium-sized enterprises that are deployable in Alberta. The competition produced more than 130 submissions, with funding recipients announced in spring 2017.

The call offered applicants a streamlined, harmonized model with one window for access to two pools of money, making it easier for applicants to access funding from both organizations. The process also allowed ERA and SDTC to gain a deeper understanding of each other's best practices. The knowledge ERA gained in the process will be used to make enhancements to our funding process to the benefit of innovators.

What we seek to accomplish

Increase capital for innovation and technology

- Investment is leveraged to create larger pools of capital for innovation and technology than would otherwise be available.

Increase commercialization and long-term viability of GHG emission reduction technologies with identified consumers

- Investment in solutions that have a clear customer demand results in increased technology commercialization and GHG reductions.

Where we plan to have an impact

Increased supply and use of clean technology, products and practices

- More efficient and effective use of publicly funded programs focused on stimulating GHG emission reducing technology deployment.

Accelerated adoption of clean innovation

- Successful and profitable companies commercialize solutions demanded by the market place.

Increased skills and employment in clean technology sectors

- Increased attraction of investment to Alberta.

What we plan to measure



Number of projects (total and completed)



Investment leverage



Partnership and collaborative activities (number established; joint funding)



Project technology readiness level (TRL) progression

5.3 Strategic Priority #3: Measure and Communicate Success

Define and report on metrics to demonstrate results.

What we plan to do

Monitor and evaluate progress of funded projects

- Active monitoring and stewardship of current and future funded technology projects.

Communicate progress of ERA's funded projects

- Celebrate and communicate our expertise, successes, and learnings.
- Demonstrate the return on ERA's investments.

What we plan to deliver

Reporting of project GHG emission reductions, economic impacts, and learning from technology development

- Annual report published on ERA website.
- Benchmark study and ongoing assessment of the level of awareness of and attitudes toward ERA.
- Reporting of project outcomes and impacts, including total GHG emission reductions, GDP impacts, and job creation.

Stewardship reports

- Demonstrate progress in support of Climate Leadership Plan, innovation system, and Technology Roadmap targets and deliverables.
- Quarterly reporting regarding measures of success.

Participation, sponsorship and hosting of events aligned with ERA's mandate

- Host and participate in media and outreach events celebrating Alberta's climate and innovation success stories.
- Host and participate in conference and workshop events that help identify, accelerate, and celebrate innovative solutions to reducing GHGs in Alberta.

Communicating Success

ERA uses a number of mechanisms to communicate its successes to government, to the innovation community, and to the public. Our annual report is a key mechanism for delivering on our commitment to government to measuring progress and demonstrating success. The report is published on our website each year and profiles the game changing solutions we are advancing along the innovation chain to address GHG emissions and benefit Alberta's economy and environment.

Each quarter, ERA provides a Stewardship Update to government. This public document provides a snapshot of ERA's current project portfolio and our progress in support of targets and deliverables defined in the Climate Leadership Plan.

ERA also works with the government to celebrate our funding recipients and project successes. A good example is the spring 2017 announcement of our Grand Challenge Round 2 winners, who were recognized in a news release jointly issued by ERA and the Government of Alberta and at a media event held at the Propel Energy Tech Conference.

What we seek to accomplish

Increase awareness of value for investment for ERA funders

- ERA is viewed by government and other stakeholders as an effective partner for accelerating solutions to reduce GHG emissions through the innovation system.

Increase awareness of ERA's strengths and credibility as a leader in GHG emission reduction

- Increased confidence in Alberta's investment in GHG emission reduction technologies.

Increase recognition of Alberta as an innovation and clean technology leader

- Increased global reputation regarding Alberta's environmental stewardship efforts and results.

Where we plan to have an impact

Increased support and engagement of Albertans

- Recognition of ERA as a key contributor to Alberta's innovation and technology leadership in a lower carbon world.

What we plan to measure



Stakeholder awareness of and attitudes towards ERA (by sector and jurisdiction)



Number and impact of communications and outreach events (hosted and sponsored)



Contribution to Climate Leadership Plan measures and 2030 Innovation Targets

5.4 Strategic Priority #4: Advance Operational Excellence

Strive for excellence in operations and efficiency while maintaining responsiveness to stakeholders and funders.

What we plan to do

Incorporate information and learning to improve ERA's intake, evaluation, and funding processes

- Review and revise Board and management operating activities and practices to maximize contribution to Government of Alberta priorities.
- Improve the ERA intake process and make the decision making cycle more efficient, including exploring opportunities for continuous intake.
- Build our corporate capacity by maintaining a strong link to Alberta Innovates Clean Energy and Biological teams and other key service providers.
- Create a sustainable and predictable funding model.

What we plan to deliver

Alignment of operating activities with GOA priorities, policies and procedures

- Business Plan and annual report provided to government each year in accordance with The Climate Change and Emissions Management Fund Administration Regulation and ERA's MOU and grant agreement with the province.
- Establishment of clear and focused outcomes and objectives, short and long-range goals and robust metrics that align with those of the province.

Partnership Intake Pilot

Like the innovators we support, at ERA we learn by doing. We have successfully funded over 100 projects through our call for proposal model, but we know there are additional opportunities to support promising technologies outside of this structured process. To provide greater flexibility, we are piloting a process that will allow ERA to evaluate and consider proposals from trusted partners outside of our standard calls for proposals. This will also allow ERA to leverage the due diligence processes of trusted partners like Alberta Innovates and SDTC – increasing our efficiency and decreasing turnaround time for funding, while maintaining the rigor and transparency of our evaluation processes.

Business Delivery Model Review

- Efficient, effective and transparent operations that ensure accountability to stakeholders.
- Decrease turnaround time from the beginning of a call to the approval of funded projects.
- Multi-year funding commitment to the innovation system.

What we seek to accomplish

Increase operational effectiveness and efficiency in ERA's decision making cycle

- Measurable organizational results aligned with stated goals and budgets.
- ERA's operations contribute to overall innovation system goals and objectives.

Where we plan to have an impact

Alberta is recognized as a climate leader

- Increased confidence in ERA's ability to support Alberta's action on climate change.

What we plan to measure



Operating costs as a percentage of approved project commitments



Length of ERA intake and decision-making cycle



Board effectiveness

6.0 MEASURING SUCCESS

One of ERA's key strategic priority areas is to "Measure and Communicate Success". Performance management and communication excellence are critical to demonstrating that ERA is delivering on its mandate, vision, strategic objectives, established goals, and core values. Relevance, quality, and timeliness are important dimensions of measuring and communicating our performance, and ERA understands the need for ongoing development and process improvement for sharing results with our partners.

ERA is an established and integrated partner of the overall innovation system, and its efforts are aligned with the system's defined provincial, national, and international metrics. To demonstrate its contribution, ERA tracks and reports metrics on a cumulative and annualized basis.

The Climate Change and Emissions Management Fund Administration Regulation and ERA's MOU and grant agreement with the Province encapsulate our shared commitment to establishing common outcomes and objectives, setting short and long-range goals and measuring progress. Our Business Plan and annual report, which ERA is required to provide to the Government annually in May and November, respectively, are key tools for ERA to communicate that it is delivering on that commitment.

ERA's primary mandate is accelerating technologies that reduce GHG emissions in Alberta. To demonstrate and communicate how we are delivering results, and as set out in the MOU with the Province, ERA is committed to establishing and reporting on portfolio-based performance outcomes and measures that quantify our projected or estimated "return on investment" in terms of GHG emission reductions at a portfolio and cumulative level.

While reduced GHG emissions are core to both ERA's mandate and Alberta's Climate Leadership Plan, it is not the ultimate outcome. ERA's vision and the outcomes of the Climate Leadership Plan are aligned in striving to deliver a lower carbon, diversified economy and enhanced wellbeing for Albertans.

The Province has also committed that the revenue generated from the carbon price will be reinvested back into Alberta's economy. While ERA's mandate allows us to invest in technologies from anywhere in the world, we require that there is a demonstrated benefit to Alberta. As a result, 92 per cent of ERA's funding goes to Alberta-based projects. Furthermore, we have committed in our Grant Agreement that we will report to the Province any cases where ERA has identified a promising investment opportunity from outside Alberta's borders, and will clearly indicate the specific benefit to Alberta derived from that investment.

ERA is working with the Province to establish goals and metrics that also quantify our expected contributions to Alberta's desired economic and societal outcomes, including economic competitiveness, investment attraction, and employment.

6.1 Metrics Approach

ERA is building a stronger performance measurement approach that is fully aligned with the measurement efforts led by the Government of Alberta. ERA has engaged key government departments, including the Alberta Climate Change Office and Economic Development and Trade, to ensure that the goals and activities laid out in our Business Plan directly support the province's outcomes and objectives around reduced GHG emissions; a lower carbon, diversified economy; and increased community well-being.

ERA currently quantifies and reports on projected GHG emissions reductions that will be delivered by our projects, on both a portfolio and cumulative basis. Going forward, we will work with the Alberta Climate Change Office to ensure that our portfolio-based reporting aligns with and supports key systems-level desired outcomes of the Climate Leadership Plan, such as increasing renewable energy, energy efficiency, and supply of lower emission energy sources.

ERA calculates two different but related emissions reductions projections for our investment portfolio. The first is the total of the GHG emissions reductions anticipated from each project directly. This value is provided by our project proponents and reviewed by ERA to ensure the basis and methodology for the estimate is sound.

The second metric is the market potential for GHG reductions. Market potential estimates the total emission reductions expected to occur should the technology be commercialized and adopted under forecast market conditions. A number of considerations and assumptions underpin this calculation, including policies and measures currently in place and arising from the successful commercial adoption of technologies into Alberta, GHG emissions intensity, the estimated market size, various economic indicators and the lifespan of the technology.

Currently, the market potential for reductions is calculated using a standardized methodology and common assumptions that are applied to each project. This allows the estimated market GHG reductions from each project to be easily compared. However, this "one size fits all" approach may not result in the most accurate estimate of market potential for each type of technology or company. As such, ERA is taking steps to improve this calculation by using assumptions like expected market adoption rate and estimated market share value that are unique for each technology, rather than the common assumptions used in the past. In addition, efforts are being made to extend the market emission reduction estimates out to 2050 to provide projections on the longer-term emission reduction benefits of ERA's portfolio.

In addition to environmental metrics, ERA is improving its reporting on economic and societal outcomes. Two metrics that have been identified as key to these outcomes include gross domestic product (GDP) and job creation resulting from ERA investments. In 2016, our organization worked with the Department of Economic Development and Trade to estimate the economic impact of ERA's projects and related investments during the ten year period from 2010 to 2019 (section 2.2). This work benefitted from the rigor of the data that ERA gathers from its projects. Going forward, ERA will work with the department to ensure we continue to gather information and report on metrics that will both inform and align with Government

efforts to measure and quantify contributions to economic growth, investment attraction, and employment.

In this vein, ERA will also undertake a process improvement exercise to identify additional data that needs to be collected from project proponents – both what we collect and when we collect it. This will include information related to employment by project and the flow of investment for projects, including amounts spent in and out of Alberta, as well as partner contributions flowing into Alberta. Changes to our Environmental Data Management & Compliance Reporting System, ERIMS, are underway to reflect these updates and enable efficient data collection and reporting going forward.

Given that ERA's investments often deliver results years in the future, many of our performance metrics are forward-looking, projecting future GHG emissions reductions, investment and job creation. However, in addition to such forward-looking performance measures, a program of post-audit performance measures to track how closely actual performance compares with our projections is also necessary. This reporting should be done in the context that investment in innovation carries an intrinsic level of risk, and the role of ERA's investments is to help de-risk prospective future contributors to the Alberta economy.

In 2017, ERA will develop processes to monitor impacts on emissions and economic activity, including leveraged investment, during the course of the projects. Longer-term impacts following completion of the funded project will also be tracked. These include environmental impacts (domestic and international) as well as economic impacts, such as employment, attracted investment, domestic and export sales. Outcomes will then be compared and reported against forward-looking projections made at the time of investment.

As part of this “retrospective” measurement program, ERA will develop an analysis of how technologies within ERA's portfolio have progressed along the innovation spectrum from a technology readiness level perspective, in part as a result of ERA funding. This work will be important to inform how ERA's work is helping to accelerate technologies, as well as better understand the broader system challenges faced by our projects.

6.2 Performance measures and reporting

 <p>Environment</p>	<ul style="list-style-type: none"> • GHG emission reductions achieved by each project (estimated and actual) • Related environmental benefits reported by each project • Reporting to demonstrate contributions to Climate Leadership Plan goals and measures of success • Post-audit performance reporting to track how actual performance compares with projections
 <p>Economic</p>	<ul style="list-style-type: none"> • Investment in projects by strategic focus area (ERA and total) • Investment leverage • Reporting on estimated contributions to economic competitiveness, including GDP and job creation • Post-audit performance reporting to track how actual performance compares with projections • Operating costs as a percentage of funds required to fulfill approved project commitments
 <p>Technology</p>	<ul style="list-style-type: none"> • Number of funding rounds per year • Number of collaborative / partner resources developed • Reporting on contributions to 2030 Innovation Targets • Reporting on ERA project technology readiness level (TRL) progression
 <p>Community</p>	<ul style="list-style-type: none"> • Reporting on alignment of operating activities with Government of Alberta policies and procedures • Length of ERA intake and decision-making cycle • Reporting on level of awareness of and attitudes toward ERA • Number and impact of communications and outreach events

7.0 OPERATING BUDGET

Emissions Reduction Alberta (ERA)					
2017/18 to 2019/20 Operating Budget					
	2016/17	2016/17	2017/18	2018/19	2019/20
	Budget	Forecast	Budget	Budget	Budget
	\$	\$	\$	\$	\$
Revenue					
Grant revenue	70,000,000	33,000,000	100,000,000	100,000,000	100,000,000 (a)
Interest income	3,156,544	3,133,049	3,219,756	3,345,671	2,908,894 (b)
Total Revenue	73,156,544	36,133,049	103,219,756	103,345,671	102,908,894
Program Expenditures	95,150,760	55,732,511	83,171,273	101,758,558	92,270,025 (c)
Revenue less Program Expenditures	(21,994,216)	(19,599,462)	20,048,483	1,587,113	10,638,869
Operating Expenses					
General & Administrative Expenses					
Corporate costs (i.e. phone, printing, meals & travel)	80,000	60,000	80,000	81,600	83,232
Insurance	20,000	12,000	20,000	20,400	20,808
GST expense	156,000	156,000	150,000	155,000	160,000
Total General & Admin Expenses	256,000	228,000	250,000	257,000	264,040 (d)
Contractor / Service Provider Expenses					
Administration, financial risk reviews, GhG reviews, project monitoring and internal project audits	1,650,845	1,725,630	1,699,877	1,733,875	1,768,552 (e)
Project review, evaluation and management	1,046,627	1,168,323	1,111,910	1,134,148	1,156,831 (f)
Legal	440,000	440,000	400,000	408,000	416,160 (g)
Operations	415,000	363,218	515,000	525,300	535,806 (h)
Communications	794,975	860,322	883,450	901,119	919,141 (i)
Commercialization Support	251,000	183,500	225,000	229,500	234,090 (j)
Total Mgmt Support Contractors	4,598,447	4,740,993	4,835,238	4,931,942	5,030,581
Other Contracted Services and Special Initiatives					
Consulting contracted services	450,000	265,000	435,000	443,700	452,574 (k)
Biological and Strategic Programs	720,000	595,000	400,000	408,000	416,160 (l)
Spark 2017 Conference Costs	250,000	150,000	100,000	75,000	75,000 (m)
Total Other Contracted Services and Special Initiatives	1,420,000	1,010,000	935,000	926,700	943,734
Governance					
Board remuneration and expense	75,000	75,000	75,000	76,500	78,030 (n)
Professional fees (i.e. audit)	45,000	45,000	45,000	45,900	46,818 (o)
Total Governance	120,000	120,000	120,000	122,400	124,848
Total Operating Expense	6,394,447	6,098,993	6,140,238	6,238,042	6,363,203
Surplus / (Deficiency) of Funds for the year	(28,388,663)	(25,698,454)	13,908,245	(4,650,929)	4,275,665
Total Funds Under Management - beginning of year	262,433,078	265,936,846	240,238,392	254,146,637	249,495,707 (p)
Total Funds Under Management - end of year	234,044,415	240,238,392	254,146,637	249,495,707	253,771,373
Committed Funds for Approved Projects	470,494,241	428,652,911	523,652,911	623,652,911	723,652,911 (q)
Total Project Funds paid to date	(241,171,028)	(199,020,924)	(282,192,197)	(383,950,755)	(476,220,780)
Remaining Funds required to fulfill approved project commitments	229,323,213	229,631,987	241,460,714	239,702,156	247,432,131
Uncommitted Funds	4,721,202	10,606,405	12,685,923	9,793,551	6,339,241
Operating costs as a % of Funds Required to Fulfill Approved Project Commitments	2.8%	2.7%	2.5%	2.6%	2.6% (r)

Notes and assumptions

- (a) 'Grant Revenue' for all three years is forecast to be \$100 million per year. ERA's allocation is decided each year after the compliance deadline has passed. ERA's Grant agreement with the Government of Alberta is currently being executed and renewal is expected by the end of this month. Payment of the FY17 Grant allocation of \$33 remains outstanding as of budget preparation.
- (b) 'Interest income' has been based on cash flow projections for the Corporation. Interest rate assumptions are based on interest rates currently being earned by the Corporation at 1.20% for the Premier Investment Account for amounts held over \$200M and 0.90% for the Operating Account.
- (c) 'Program expenditures' have been budgeted based on signed contribution agreements or on a set of assumptions regarding approved and anticipated funding for projects.
- (d) 'General and Administration Expenses' are budgeted to be consistent with the current year operating model incorporating the changes being considered by Management.
- (e) 'Administration, due diligence, project monitoring and internal project audits' costs are anticipated to be consistent with FY17 budget and activity levels.
- (f) 'Project review, evaluation and management' costs are expected to be consistent with FY17 budget and forecast levels.
- (g) 'Legal' costs are expected to be consistent with FY17 budget and forecast results.
- (h) 'Operations' costs are expected to be in line with the current contracts, including the Director of Policy and Planning, which will now be a direct bill to ERA and has moved to 'Operations' from 'Project review, evaluation and management'.
- (i) 'Communications' costs have been contemplated in conjunction with the ERA Communications Plan for FY18. Increase in FY18 relates to delivery of Spark 2017 and the EDT conference in spring of 2018.
- (j) 'Commercialization Support' costs have been budgeted to increase in FY18 over the FY17 forecast due to increased engagement with Grand Challenge Proponents and participation in the SWAT team approach.
- (k) 'Consulting Contracted Services' include research consulting costs to support the RFP process, research initiatives and collaboration projects. FY18 budget contemplates an increase in level of engagement with partners over the FY17 forecast amount and an increase has been budgeted accordingly.
- (l) 'Biological Program' is currently being rationalized by Management and the delivery model related to this program has yet to be determined. A placeholder has been included in the budget for this program.
- (m) 'Spark 2017 Conference' is planned to be held in November 2017. Costs represent ERA's anticipated net investment in the conference.
- (n) 'Board remuneration and expense' budget remains consistent with the current year forecast.
- (o) 'Professional fees' comprise audit fees and remain consistent with the current year forecast.
- (p) Based on Cash flow model for the month ended December 31, 2016. Represents CCEMC's total funds under management.
- (q) Based on actual funding approved for remaining active projects in Round 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, Grand Challenge, Adaptation and Biological and assumptions for Call 1 and 2. For future approved rounds, this has been based on estimates. Funds are shown as committed once the EOI cycle has started for a particular Call.

	\$	
Round 1	53,667,721	
Round 2	24,047,999	
Round 3	10,000,000	
Round 4	36,023,000	
Round 5	4,093,569	
Round 6	6,716,405	
Round 7	26,304,788	
Adaptation	6,990,662	
Biological	6,000,000	Note: Includes \$2.0 million for future projects
Grand Challenge	36,753,012	Note: Includes \$15 & \$10 million for Rounds 2 & 3 respectively
Round 8	9,161,141	
Round 9	15,558,175	
Round 10	86,143,300	
SWOT / Partnership Fund	15,000,000	
Round 12 -SDTC Joint Call	12,193,139	
Call 1 - Methane	40,000,000	Note: Approval in May 2017 expected
Call 2 - TBD	40,000,000	Note: Launch in Spring 2017 expected
	428,652,911	
Future Rounds	\$	
2017/18	95,000,000	Note: Includes forecast of \$40 million each for Calls 3 & 4 and \$15 million for Partnership Intake - Pilot program
2018/19	100,000,000	Note: Includes forecast of \$40 million each for Calls 5 & 6 and \$20 million for Partnership Intake
2019/20	100,000,000	Note: Includes forecast of \$35 million each for Calls 7 & 8 and \$30 million for Partnership Intake

- (r) This metric represents total ERA Operating costs for the year as a percentage of the funds required to fulfill all remaining project commitments approved by the ERA Board of Directors.
- (s) This budget is dependent on the level of financial support and direction from the Government of Alberta. Should the Grant vary materially from \$100 million, the operating budget will be adjusted to reflect the associated changes in activity level.