CCEMC

BREAKING THROUGH

CLIMATE CHANGE AND EMISSIONS MANAGEMENT(CCEMC) CORPORATION

ANNUAL REPORT 2015/2016

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INTRODUCTION AND MANDATE

INTRODUCTION

Great things happen when all the right elements align.

We create outstanding solutions when we come together with a commitment to change Alberta's future for the better. The technologies we invest in are gaining momentum, and projects are producing results. We are accelerating the advancement of technologies to reduce greenhouse gases (GHGs), and we are helping to strengthen and diversify Alberta's economy.

Many projects we've invested in are reaching completion. Real solutions demonstrate that innovation and collaboration will enable Albertans to work together to fully harness the power of our tremendous natural resources to be a climate change leader.

A lower carbon future is a big mountain to climb, but we're getting there. We're breaking through.

CCEMC MANDATE

Mandate
The mandate of CCEMC is to establish or participate in funding for initiatives that reduce emissions of GHGs or improve the ability to adapt to climate change within Alberta and beyond.

Mission
CCEMC's mission is to achieve actual and sustainable reductions in GHG emissions in Alberta and facilitate climate change adaptation through the discovery, development and deployment of transformative clean technology.

Goals
CCEMC has identified four goals and supporting strategies that are the basis for delivering on the mandate and mission of the corporation:

1. To fund technology projects that achieve actual and sustainable reductions in GHG emissions.
2. To support the research, development and deployment of transformational technology.
3. To improve the knowledge and understanding of climate change impacts, mitigation strategies, adaptation and technological advancements.
4. To demonstrate full accountability to all Albertans.

CCEMC Management Team (from left to right) Mark Summers, Amanda Amyotte, Heather Stephens, Elizabeth Shirt, Jennifer Cleall and Steve MacDonald.

MESSAGES

MESSAGES

LETTER FROM THE MINISTER

Climate change is a fact. It is also fact that many of the solutions that are needed to mitigate the impacts of climate change lie in innovation and research.

To support this, the Alberta government launched its Climate Leadership Plan in November 2015. It provides a foundation for innovation to thrive in the province so Albertans can work together to create a higher value, lower carbon and energy efficient economy.

Alberta's Climate Change and Emissions Management (CCEMC) Corporation is an important part of our efforts. Through investments in innovative clean technology, CCEMC creates opportunities for business and will help Alberta reduce carbon pollution. In the process, the organization supports our efforts to diversify the economy, create jobs, and protect the health of Albertans.

Investments in innovative technologies will make Alberta one of the most environmentally responsible energy producers in the world.

It's the right thing to do today and for future generations.

The Honourable Shannon Phillips
Minister of Environment and Parks
Minister Responsible for the Climate Change Office

LETTER FROM THE CHAIR

Over the past year, CCEMC initiated work to transition to a new era and renew our organization. We reached across the province to begin a new dialogue and to ensure alignment with the Alberta Climate Leadership Plan. We now have a new mandate, and we have honed our focus to accelerate development of innovative technologies. As part of that work, we brought the adaptation program to a close and we are targeting our efforts towards areas where our funds and expertise can add the greatest value.

We enhanced engagement with Large Final Emitters to confirm that the technologies we advance will meet their needs as we move towards a lower carbon economy.

CCEMC also strengthened relationships across Canada. We have collaborated with other funders and organizations to advance the opportunities that address Alberta's interests. We share common goals and, by working with organizations like Sustainable Development Technology Canada (SDTC), we cast our net wider and better leverage our funding.

At the heart of our work are the GHG reductions that we will achieve and the technologies that CCEMC supports. This includes technologies that reduce methane emissions, and a trio of energy efficiency projects led by Alberta oil and gas producers.

By sharing their knowledge, the industry partners behind these initiatives encourage broader adoption of multiple technologies that support Alberta's Climate Leadership Plan.

We're moving carbon dioxide (CO_2) from a waste product to an asset. In the past fiscal year, we entered the second round of the CCEMC Grand Challenge: Innovative Carbon Uses. Up to five winners will each receive $3 million in 2017 to advance their GHG-reducing technologies in Alberta. The Grand Challenge approach will accelerate development of these technologies and create jobs as the ideas advance.

Biological projects also produced results over the past year. For example, one of the projects CCEMC funded used components from plant oils developed by the Lipid Chemistry Group at the University of Alberta to create a more sustainable bio-based spray foam insulation for the construction industry. Today, this technology is being commercialized.

The current economic environment makes this the right time for innovation. It is abundantly clear that we must invest in transformative technology to tackle GHG emissions; in the process, we will diversify the economy, create jobs and access new markets.

To support the complex work ahead, CCEMC welcomed Steve MacDonald to lead our team as interim CEO. A key player in the development of Alberta's Climate Leadership Plan, Steve has a long history in government and is helping to strengthen CCEMC's relationships with Alberta's industry partners and the clean tech community across Canada.

We've been building a strong foundation to advance new ideas.

Now we're breaking through.

Kathleen Sendall, C.M.
Chair, Climate Change and Emissions Management (CCEMC) Corporation

LETTER FROM THE CEO

The new Alberta Climate Leadership Plan is creating opportunity for innovators. The Plan puts in place policy and regulatory measures that will drive the need for performance improvements enabled by technology. The government is creating the conditions for success.

CCEMC is part of this effort. We're funding projects to accelerate the development of the innovative technologies that Alberta—and the world—needs.

Our organization has made significant progress since we began funding projects in 2010.

So far, we have committed funding to more than 100 active projects that will help Alberta transition to a lower carbon economy. In the past fiscal year, 39 of our projects reached completion, with another three complete subsequent to year-end. Each of these projects is moving us closer to the solutions necessary for Alberta to be successful in a lower carbon future.

It is a challenging business and CCEMC must address multiple timescales. To innovate successfully, we must keep both the short and long games in mind. We're addressing this challenge by focusing on clear outcomes across multiple timeframes and by applying a systems perspective with enhanced engagement and collaboration.

In the past year, we formalized additional collaborative relationships, including one with Sustainable Development Technology Canada (SDTC). Together, CCEMC and SDTC have made $40 million in funding available for GHG-reducing projects that are applicable to Alberta and that are led by small and medium enterprises.

Our continued support for the next generation of technology will help Alberta to meet its long-term emissions reduction goals, and will help create demonstration and deployment projects that will deliver emissions reductions in the near-term.

The next year will hold more changes for CCEMC as we refine our focus, prepare to offer new funding opportunities and begin to more actively leverage the broader ecosystem to set our projects on the path for success.

In closing, I thank our Board for their leadership over the past year and the innovators behind our projects for their commitment to delivering bold solutions for Alberta and for the world.

Steve MacDonald
Interim CEO, Climate Change and Emissions Management (CCEMC) Corporation

ACHIEVEMENTS

ACHIEVEMENTS

CCEMC tracks its performance to help measure the success of our investments and the technology we're supporting. Our current metrics include:

- GHG Emissions Reductions – The amount of GHG emissions at the project level predicted to be reduced from a business-as-usual scenario based on an assessment of possible market penetration as anticipated from the projects approved. Figures are reported on a cumulative and an annualized basis and against specified reporting periods such as 2020.
- Fund Allocations – CCEMC funds allocated to sectors and strategic investment areas.
- Project Success – Successful, challenged or incomplete projects (status); how projects span or progress along the innovation spectrum; attrition; and, where possible, relevant co-benefits.
- Corporate Efficiency – CCEMC's ability to operate as efficiently as possible.

GHG EMISSIONS REDUCTIONS

Our investments in transformative technologies, which have the potential to dramatically reduce GHG emissions across sectors, will play a critical role in achieving the province's long-term reductions goals.

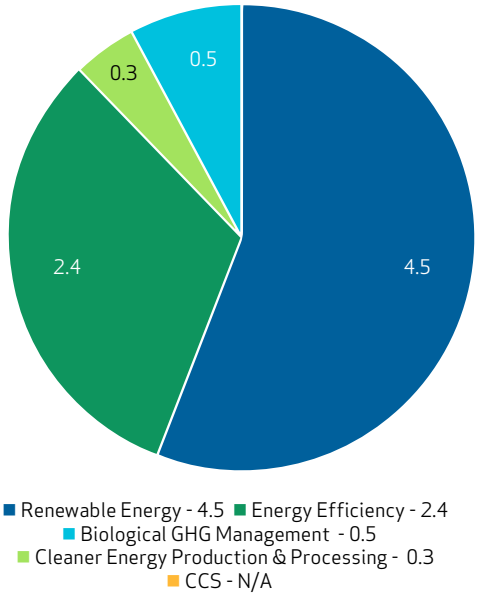
CCEMC also funds demonstration and deployment projects that will result in substantial near-term emissions reductions. We estimate that CCEMC-funded projects will reduce GHG emissions by more than 7 megatonnes by 2020.

One megatonne is roughly equivalent to the GHG emissions produced by 200,000 passenger cars in a year.

Investments in 12 projects related to renewable energy, industrial energy efficiency and methane reduction account for the majority of these near-term reductions. Most notably, it is estimated that the Blackspring Ridge Wind Project will reduce GHG emissions by 3.7 megatonnes by 2020.

CCEMC funding commitments that support transformative technologies are generally at an earlier stage of development. The benefits of these investments will become clear once these technology solutions are adopted in the marketplace.

PROJECT REDUCTIONS BY STRATEGIC INVESTMENT AREA (ROUNDS 1-10)
(MEGATONNES BY 2020)



FUND ALLOCATIONS

Investment by Strategic Area

Since CCEMC launched our first funding round in 2010, our portfolio was designed to reflect the 2008 Climate Change Plan and Alberta's policy direction of the day. Although our 2015/16 investments are based on this earlier work, they also reflect many of the priorities of the Climate Leadership Plan that was announced in November 2015.

Strategic areas for CCEMC include:

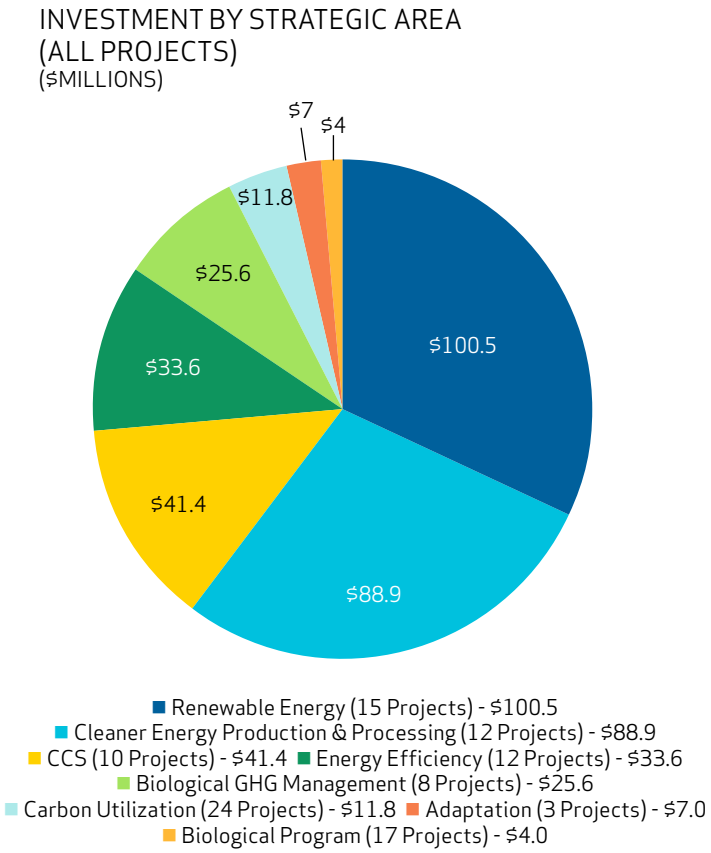
- Renewable energy
- Energy efficiency
- Cleaner energy production and processing
- Biological GHG management
- Carbon capture and storage

We address biological GHG management through a biological program that is administered by Alberta Innovates Bio Solutions. The program aims to identify barriers and opportunities to accelerate GHG emissions reductions in Alberta's biological sector. CCEMC has also funded biological projects through a competitive funding process.

The largest area of investment to date is renewable energy, followed by cleaner energy production and processing.

CCEMC brought the adaptation program to a close during the year. All projects were concluded and key findings were shared in a half-day interactive workshop in October 2015. CCEMC also supported a one-day adaptation conference in collaboration with the province in January 2016 to build broader engagement and understanding with stakeholder groups.

Although CCEMC's enabling legislation allows for the corporation to invest in technologies and projects in support of climate change adaptation, our funds and expertise will best add value by focusing on technologies in support of emissions reductions to mitigate climate change.



PROJECT SUCCESS

Innovation carries considerable risk. Projects may not produce the intended results, and initiatives do not always deliver the results we expect. This is part of the risk that CCEMC assumes.

CCEMC began funding projects in 2010 and, by the 2015/2016 year-end, a total of 52 projects were complete, with 39 reaching conclusion in the 2015/16 fiscal year. Three additional projects were completed in the subsequent event period that ended September 21, 2016.

52 PROJECTS COMPLETED

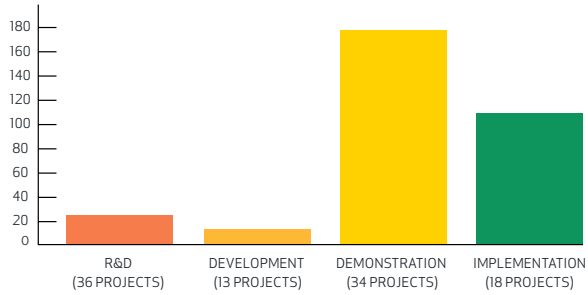
Year	Number of projects completed
2010/2011	0
2011/2012	2
2012/2013	4
2013/2014	3
2014/2015	4
2015/2016	39

INVESTMENT BY INNOVATION STAGE

CCEMC investments span the innovation chain; however, CCEMC's technological expertise and funding capacity lends itself to targeting an area of known need between prototype and technology scale-up.

CCEMC INVESTMENT BY INNOVATION STAGE

($ MILLIONS)



LEVERAGE

CCEMC aims to achieve a leverage rate of 4.1 or more. We currently have a leverage rate of 6.2:1 for projects that reduce GHG emissions. Put another way, for every dollar that CCEMC invests in clean tech, more than another $6 are also invested.

As with GHG reduction estimates, the leverage figure is significantly affected by a few large projects. For example, CCEMC leveraging drops from 6.2:1 to 4.4:1 when the Blackspring Ridge project is excluded from the calculation.

PROJECT VALUE
$2,187,544,843

CCEMC COMMITMENT - MAY 31, 2016
$305,791,238

ECONOMIC IMPACT

While CCEMC focuses on technology, innovation and reducing GHG emissions, these investments also bring significant economic benefits in the form of new jobs and further investment. They also have a direct impact on gross domestic product.

The Conference Board of Canada estimates that the total economic benefit of investments partly funded by CCEMC from 2011 to 2016 will be more than $2.4 billion—with $1.95 billion in Alberta.

They also projected that CCEMC would help contribute 12,244 person-years of full-time equivalent employment in Alberta, with supply chain impacts in areas such as construction, manufacturing and commercial services. Actual employment is estimated at 15,362 when part-time jobs are included.

Person-Year – A person-year is a unit of measurement based on an ideal amount of work done by one person in a year.

CORPORATE EFFICIENCY

One measure of efficiency is the cost of administration.

Administration costs are reported as the percentage of funds required to fulfill approved project commitments.

The CCEMC Board of Directors determine the cost of administration on an annual basis with due regard to maximizing available funds for projects. CCEMC budgeted 3.9% for the cost of administration and the actual cost for 2015/16 was 2.8%.

Our financial statements are included at the end of this report.

SUCCESS THROUGH COLLABORATION

Collaboration is at the core of everything we do. CCEMC works closely with colleagues at Alberta Innovates – Energy and Environment Solutions, who serve as project advisors to CCEMC. We also rely on staff from Alberta Innovates Biological Solutions, who administer our Biological Program. TEC Edmonton and Innovate Calgary, who make commercialization support available to our projects, are also part of the team.

Over the past year, CCEMC further strengthened its capacity to accelerate new technology development through working in partnership with other organizations.

SDTC MOU AND FUNDING OPPORTUNITY

We built a strong relationship with SDTC after signing a Memorandum of Understanding (MOU) with this national funding organization in April 2015. Over the past year, we have worked closely to design and implement a joint funding opportunity that addresses the interests of both organizations.

Targeting Canadian small and medium enterprises, the $40 million initiative sought innovative technologies that support areas identified in Alberta's Climate Leadership Plan. The competition produced more than 130 submissions, with project selection scheduled for the coming year. Successful projects will reduce GHG emissions and will be applicable in Alberta.

"The volume of high-quality submissions confirms that there are lots of bright ideas out there, and many opportunities to apply innovative technologies to address climate change in Alberta," says CCEMC CEO Steve MacDonald. "By working together, CCEMC and SDTC can leverage the strengths of both organizations to advance the best projects and help them succeed."

"This funding opportunity is our first true collaborative effort with SDTC," says CCEMC Director of Projects Mark Summers. "We will continue to work together to accelerate innovation and support project developers."

CCEMC and SDTC also gained a deeper understanding of each other's best practices. The knowledge CCEMC gained in the process will be factored in to make enhancements to our funding process to benefit innovators.

CCEMC Director of Projects Mark Summers.

ONTARIO CENTRES OF EXCELLENCE MOU

CCEMC signed an MOU with the Ontario Centres of Excellence (OCE) in May to bolster cross-provincial innovations that will reduce GHG emissions. OCE, a chief driver of cutting-edge research commercialization in Ontario, works with industry to provide support for and invest in early-stage projects with a high probability of success.

"Alberta is taking a leadership role in combating climate change with our Climate Leadership Plan, which values partnerships and knowledge sharing," says Alberta Premier Rachel Notley. "This collaborative effort will ensure that knowledge and expertise cross borders to reduce greenhouse gas emissions, create new high-tech jobs, and protect the health of Alberta's and Ontario's residents."

We are working with OCE to find opportunities to advance innovation and technology under the MOU, including a process to recommend suitable projects for funding consideration where there is a high potential to reduce GHG emissions.

MARS MOU

In October 2015, CCEMC signed an MOU with the MaRS Discovery District (MaRS) to nurture and grow Canada's clean technology, energy innovation and low carbon sector.

Cooperative efforts under this MOU are in development and may include communications and outreach, identifying and addressing barriers faced by CCEMC and MaRS technology developers, addressing GHG emissions through Canadian technologies, and accelerating market entry for new technologies.

CELEBRATING SUCCESS

In 2015/16, many CCEMC projects reached important milestones. Here are some of our favourite success stories.

WE ARE MOVING CO_2 FROM A WASTE PRODUCT TO AN ASSET

Carbon conversion and carbon utilization technologies have the potential to play a significant role in global efforts to address climate change. These emerging technologies effectively move CO_2 from a waste product to a commodity that can be sold.

Through the Grand Challenge: Innovative Carbon Uses, Alberta reached out to the world to support the development of technologies that convert CO_2 into value-added products and chemicals.

CCEMC received 344 submissions from 37 countries in the first round of the competition, and we made commitments of $500,000 in seed funding to 24 projects to prove their technology.

We launched the second round of the $35 million competition in 2015 and received 59 new submissions to join the successful round one projects. This second round sets the bar even higher. Winning projects will demonstrate a clear path to reducing GHG emissions by one megatonne annually while presenting a realistic plan for deployment. Up to five successful projects will receive $3 million in funding to help advance their technologies in Alberta.

The final round ends in 2019, with one of the round two winners selected to receive an additional $10 million to help commercialize their technology in Alberta.

Many of the funded projects from the first round are turning CO_2 into useful products and producing results.

CREATING GREEN METHANOL

Quantiam Technologies, based in Edmonton, develops and manufactures transition metal-based coatings for process catalysis applications in extreme environments or selected industrial wear, and in corrosion resistance applications.

Their Methanol+ technology produces methanol from captured CO_2 emissions and hydrogen. Methanol has many practical applications, such as being used as a feedstock for olefin production and as a fuel additive, and it can be very effective in reducing the environmental footprint left by gasoline.

"We had excellent prototype results which, in addition to meeting our own goals with CCEMC, green-lighted continued research and the scale-up of our activities on this project," says Peter Unwin, Research Scientist with Quantiam.

This technology provides a low-cost and scalable solution to GHG mitigation while producing a high-value product for the petrochemical sector. It has the potential to generate revenue, meet global demand, and create jobs in Alberta to produce and transport methanol.

APPLYING GRAPHENE FOR STRONGER SUBSTANCES

Graphene is heralded as a miracle material: just one atom thick, it is stronger than steel and a better conductor of electricity than copper.

Carbon Upcycling Technologies from Calgary has been working on carbon conversion since 2013. Founder Apoorv Sinha strongly believes that carbon can be a valuable resource—not just a waste product.

Their technology converts CO_2 into graphene by processing the CO_2 with graphite in a mill reactor. The resulting reaction produces carboxylated layers of graphene. The product has the potential for multiple applications, including strengthening cement- or polymer-based products like plastic bottles and yoga mats.

"We were encouraged by the fact that we didn't have to break down the CO2 molecule because this saves a lot of energy," says Sinha. "It's much better if you can find a way of absorbing or capturing it in a solid product."

Carbon Upcycling Technologies is reaching out to cement mixers and polymer companies to position the product as a cheaper, stronger and more efficient filler. If we can use waste CO_2 and incorporate it into common goods like cement, plastic bottles and yoga mats, we will reduce the environmental footprint required to produce everyday materials around the world.

CREATING VALUABLE CHEMICALS FROM SOUR GAS

Dr. Deane Little, CEO of New Sky Energy, says his idea for the company was a eureka moment. Based out of Boulder, Colorado, the clean chemistry company focuses on resource recovery and waste treatment. Their CarbonCycle process uses a non-toxic, water-soluble base to capture CO_2 and H_2S contaminants from sour gas and convert them into soda ash, bicarbonate and sulphur. The contaminants are then put to use as carbonates, which are used to fabricate glass, paper and other everyday products.

This technology could be massively beneficial for Alberta's economy and environment. New Sky plans to expand into Alberta with a pilot operation in a sour gas field—a move that will create jobs across the province. They estimate the initiative could reduce CO_2 emissions in Alberta by an estimated 6 megatonnes annually.

"We're very interested in expanding to Canada because we think it's an excellent market in terms of available resources like sour natural gas or sodium sulphate," says Dr. Little. "The CCEMC in Alberta and Alberta's carbon tax are very important for promoting the growth of clean technologies. Without that support, it's difficult for small companies to gain traction in the marketplace."

MOVING FORWARD WITH THE CHALLENGE

Although the nature of the Grand Challenge is competitive, the focus is collective: finding carbon conversion technologies that benefit everyone. We expect that the Challenge will result in several successful projects in Alberta, creating jobs and economic benefits here at home while also helping to accelerate the development of these important technologies globally. Alberta's Canada's Oil Sands Innovation Alliance (COSIA) is also advancing carbon conversion technologies through the complementary NRG COSIA Carbon XPRIZE.

WE ARE ADVANCING THE DEVELOPMENT OF RENEWABLE ENERGY

By investing in energy storage, utility scale solar projects and other renewable energy opportunities, CCEMC is helping Alberta to accelerate renewable energy technology and to encourage adoption across our complex electric system.

INCREASING ADOPTION OF ROOFTOP SOLAR

CCEMC has advanced the adoption of solar energy through a project led by ENMAX Energy Corporation that identifies and addresses barriers associated with residential and commercial solar energy systems. The initiative pilots a new business model that reduces the up-front cost and risk for consumers who are interested in putting solar panels on their roof. It has increased adoption of rooftop solar panels, developed a skilled workforce of installers and addressed sometimes complex permitting requirements.

The installation of Canada's largest commercial rooftop solar system at the Leduc Recreation Centre was part of the ENMAX project. This one system will reduce GHG emissions by an estimated 1,000 tonnes per year. In addition to generating about 15% of the Centre's annual energy consumption, the system also has economic benefits. Based on current demand, Leduc Mayor Greg Krischke estimates that the new solar installations in Leduc will reduce electrical costs by up to $90,000 per year.

ADOPTING BIO-METHANE AS AN EFFICIENT POWER SOURCE

Renewable energy can play a major role in Alberta's forestry industry.

Slave Lake Pulp, a subsidiary of West Fraser Mills is a 240,000-tonne-per-year mill that primarily processes aspen to produce market pulp that is used globally. Pulp mills generate large quantities of waste-activated sludge that is usually incinerated, landfilled or land-applied.

In 2012, the company decided to explore bio-methane for power generation. CCEMC committed $5 million to the project, in collaboration with Canada EcoTrust for Clean Air and Climate Change, who brought $10 million to the table through the Alberta government. The project involved integrating an energy-efficient anaerobic digestion system into the mill's existing wastewater treatment system. The low-rate anaerobic treatment system is believed to be the first in Canada for the pulp and paper sector.

The system improved the performance and efficiency of the mill, with increased process stability, reduced electrical costs, lower chemical use and reduced waste sludge.

The project demonstrates that we can reduce GHG emissions in Alberta's pulp and paper industry and address a significant issue associated with waste management at the same time.

WE ARE REDUCING METHANE EMISSIONS IN THE OIL AND GAS SECTOR

It's estimated that methane leakage from oil and gas wells in Alberta accounts for approximately 3.5 megatonnes of emissions every year. Reducing methane emissions in the oil and gas sector is a key component of Alberta's Climate Leadership Plan, and it's an area that has spawned commitments from Canada, Mexico and the United States.

CCEMC has invested in several projects that address methane.

"I'm excited to see where these will go," says CCEMC's Director of Projects, Mark Summers. "We've supported terrific projects that directly address methane emissions in the oil and gas sector, and the learnings from these initiatives will support further methane emissions reductions in Alberta."

PUTTING METHANE TO GOOD USE

CCEMC invested in a pilot project with Encana Corporation that involves installing 59 different vent gas capture units in natural gas compressor stations. Compressor stations help with the transportation of natural gas, and vent methane during the process. The SlipStream technology that Encana uses captures methane and feeds it back into the stream to help fuel the compressor, resulting in increased fuel recovery and fewer GHG emissions. It's estimated that this technology will reduce GHG emissions by more than 450,000 tonnes by 2020.

USING CONTROLLERS TO REDUCE EMISSIONS AND INCREASE EFFICIENCY

Cenovus Energy installed air/fuel ratio controllers and vent gas capture on engines in gas compression facilities across Alberta. Mechanical engines in the facilities burn natural gas, injecting air into it. The more fuel in the air fuel mixture, the richer the burn and the more GHGs emitted. The air/fuel ratio controllers optimize the ratio of air to fuel to allow for a leaner burn, leading to increased efficiency and decreased emissions.

SMALL, EFFICIENT STEPS HAVE A BIG IMPACT

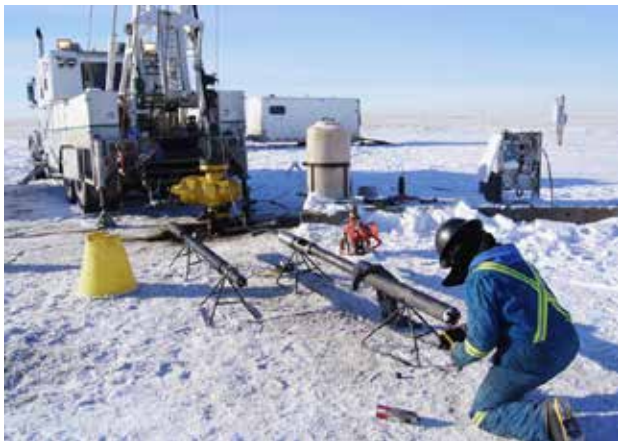
ConocoPhillips implemented 10 different technologies to help set the standard for industry best practices in GHG emission reduction technologies. High to low/no bleed instrument conversion involves reducing the methane bleed from the natural gas used to operate machines and instrumentation. This instrument conversion demonstration was the most successful technology for ConocoPhillips. They estimate that the GHG emissions reduction for this project are about 1 megatonne over a 20-year life span.

Another technology called REMVue improves the efficiency of fuel injection by reusing emitted exhaust gases to power the engine. ConocoPhillips believes this project has the potential to reduce GHG emissions by 350,000 tonnes over two years. In recognition of their work, ConocoPhillips was the recipient of an Alberta Emerald Award in 2016 for Implementing and Sharing Energy Efficiency Innovation.

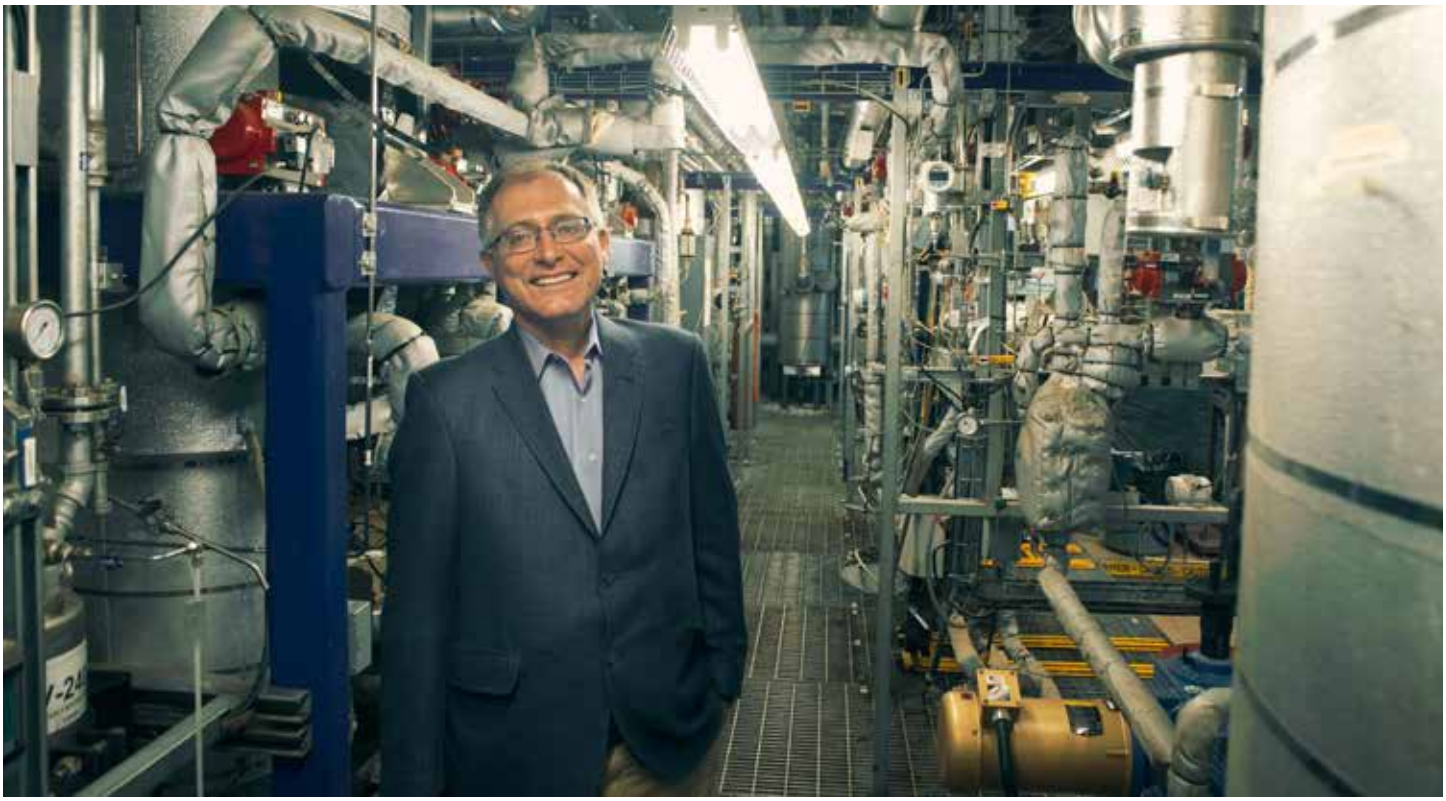
"Over the last five years, with the implementation of all of our green projects, we've reduced about 470,000 tonnes of carbon equivalency," says Sean Hiebert of ConocoPhillips. "That's something to be proud of."

BUILDING A BETTER SEAL FOR WELLS

In addition to projects that test new technologies, CCEMC also invested in a project by Calgary-based company Seal Well to support the development of their new technology. Today, Alberta oil and gas companies use concrete to seal wells once they are no longer in use, but concrete deteriorates over time—resulting in methane leaks. Seal Well developed technology that uses a bismuth-based alloy to seal oil and gas wells for the lifetime of the well. Seal Well estimates that, if they seal 750 wells in Alberta by 2025, GHG emissions will be reduced by 43,000 tonnes per year.



Seventy per cent of methane in Alberta is generated by the energy industry and these technologies have the potential to make an important contribution to help Alberta and Canada meet GHG reduction commitments.



WE ARE ADVANCING TRANSFORMATIVE TECHNOLOGIES TO REDUCE THE CARBON FOOTPRINT OF THE OIL SANDS

Government and industry are interested in finding technologies that will reduce GHG emissions in Alberta's oil sands. Through the Climate Leadership Plan, the province has capped oil sands emissions at 100 megatonnes, a level that the industry could hit within the next 10 years. Reducing GHG emissions while increasing production is a complex challenge that requires collaboration. By working together, industry, government and technology developers will help ensure that Albertans maximize the value of our energy resources over the long term while helping oil sands producers to compete in a lower carbon economy.

REMOVING SULPHUR WITH LOWER EMISSIONS

Field Upgrading celebrated the opening of their 10-barrel-per-day upgrading facility in Fort Edmonton in June 2016. The pilot facility removes sulphur in a way that's cheaper than conventional processes by mixing elemental molten sodium with high sulphur feedstock. CCEMC and SDTC both invested to move the technology closer to commercialization.

"We are on track to create a made-in-Alberta technology that has the potential to help diversify Alberta's economy and to help clean up the planet at the same time," says Neil Camarta, Field Upgrading's President and CEO.

Partial upgrading and technologies from companies like Field Upgrading will reduce the carbon footprint from oil sands products and help build a lower carbon economy.

REDUCING THE NEED FOR STEAM FOR IN SITU EXTRACTION

The Enhanced Solvent Extraction Incorporating Electromagnetic Heating (ESEIEH) Consortium is made up of CNOOC/ Nexen, Devon Canada, Suncor Energy and the Harris Corporation, an aerospace company based out of Melbourne, Florida. The CCEMC funding commitment to ESEIEH is helping to develop and implement a technology to replace steam for in situ bitumen extraction with electromagnetic—or radio frequency—heating in combination with solvent dilution.

Radio frequency waves are used to heat up the reservoir, which is then injected with vaporized solvent to reduce the viscosity of the oil. The oil can then be drained and pumped to the surface, and the solvent is reused. Because this process is much cooler than conventional steam-assisted gravity drainage (SAGD) operations, less energy is lost during the process. There is also the potential for this technology to be combined with solar, wind or hydro power, which could further reduce GHG emissions.

ESEIEH has the potential to be a game-changing technology and to have a significant impact on GHG emissions in the oil sands. As the solvent picks up more quality components, the extraction process brings back oil that's lighter and of higher value. Eliminating steam from bitumen extraction will also drastically reduce water usage and the space needed to store it at the operation.

Nsolv also has a technology that can reduce the need for steam. Their process uses proven horizontal well technology, but uses warm propane or butane injected as a vapour. It condenses underground and washes the compounds out of the bitumen. This type of technology has the potential to reduce GHG emissions by more than a megatonne per year if it is successfully developed and deployed in the oil sands industry.

These technologies, which reduce the need for steam for in situ bitumen extraction, have the potential to result in reductions in the order of megatonnes per year if they can be successfully developed and deployed in the oil sands industry.

WE ARE REDUCING EMISSIONS FROM BIOLOGICAL SOURCES

Right now, Alberta has opportunities to play a leading global role by supporting technologies that reduce emissions from biological sources. From agriculture to forestry to landfills, our biological program and funding opportunities are identifying novel solutions.

COMMERCIALIZING A GREENER INSULATION FROM CANOLA

Sprayfoam worked with Dr. Jonathan Curtis and his team at the University of Alberta to develop a bio-based spray foam insulation.

The innovation for this project lives in its product. Conventional spray foam insulation is composed of two compounds: polyol and isocyanate. Conventional polyol is made from fossil fuels, and has to be imported into Canada—making it a high GHG emitter.

To combat this, Dr. Jonathan Curtis began exploring plant-based polyols, and developed a product that uses non-food grade canola oil to make a more environmentally friendly, more efficient and less costly product. The ability to produce a bio-polyol right here in Alberta is a significant step towards reducing GHG emissions—not only because it eliminates the need to use fossil fuels in its production, but also because it eliminates the need for imports from overseas.

Sprayfoam's product is now in use in external applications for building renovations in downtown Edmonton, and is undergoing certification so it can be used in internal applications. Sprayfoam also plans to build a new bio-polyol plant in Olds, Alberta.

39 PROJECTS COMPLETED THIS YEAR

39 PROJECTS COMPLETED THIS YEAR

ENERGY EFFICIENCY PROJECTS

BFE THERMALLY DRIVEN REFRIGERATION SYSTEM

Calgary-based May-Ruben Technologies is seeking to provide people around the world with clean energy and water through technological innovation. Binary Fluid Injector technology uses a high-performance heat pump or refrigeration cycle that is driven directly by thermal energy, rather than electricity. This unlocks the potential for using renewable thermal energy—such as waste heat, geothermal, and solar thermal energy—on an industrial scale.

CARBON CAPTURE AND STORAGE PROJECTS

OTSG OXY-FUEL DEMONSTRATION

The OTSG Oxy-Fuel Demonstration Carbon Capture Technology is a means to develop a reliable, low-cost solution to capturing CO_2 from once-through steam generators that can be used on a commercial scale for in situ bitumen production. Five partners, including Suncor Energy constructed and operated a pilot plant to determine the operational challenges and real-world benefits.

CRYOGENIC CARBON CAPTURE WITH ENERGY STORAGE

Sustainable Energy Solutions Cryogenic Carbon Capture technology stores energy efficiently and changes load rapidly over a significant fraction of a power plant capacity. This technology could reduce peak load parasitic losses by shifting loads to non-peak or cheaper generation times. The rapid load change capability provides major grid management capabilities that are essential for accommodating intermittent supplies, such as wind and solar energy.

CLEANER ENERGY PRODUCTION AND PROCESSING PROJECTS

NSOLV BEST PILOT PLANT AT SUNCOR DOVER

The Nsolv process uses horizontal well technology, but uses warm propane or butane instead of water. Injected as a vapour, the solvent condenses underground and washes the valuable compounds out of the bitumen. The process produces a lighter, partially upgraded and more valuable oil product. The BEST (Bitumen Extraction Solvent Technology) Pilot Plant, which demonstrates Nsolv clean energy technology at field scale, is the result of collaboration between Nsolv Corporation and Suncor Energy, with support from SDTC and CCEMC. This is just one of several technologies CCEMC is supporting that have the potential to result in GHG emissions reductions in the order of megatonnes per year if they can be successfully developed and deployed in the oil sands industry.

ENGINEERING NATURAL GAS DUAL FUEL BLEND FOR HEAVY DUTY VEHICLES

This project from Hitec Fuel used a dual fuel technology, a conversion technology system, and added it to an existing heavy-duty vehicle diesel engine—enabling the engine to operate on a high proportion of natural gas blend. Potentially, 60% or more of the diesel fuel can be substituted with compressed natural gas (CNG) when utilizing the Hitec dual fuel technology. CNG, the cleanest of all the fossil fuels, contains less carbon than diesel, and produces lower CO_2 emissions per vehicle mile travelled. This technology is another step forward in decarbonizing Alberta's transportation fleet.

PERMANENT SEALING OF GHG-EMITTING OR SEQUESTRATION WELLS WITH A BISMUTH-BASED METAL ALLOY

This demonstration project from Seal Well helped to commercialize proprietary well-sealing technology that reduces GHG emissions from old or abandoned oil and gas wells. The company developed proprietary plugs and procedures that are more effective, more reliable and less expensive than the concrete that is currently used to seal old oil and gas wells.

RENEWABLE ENERGY

BLACKSPRING RIDGE WIND PROJECT

The Blackspring Ridge Wind Project represents the largest investment in wind energy in Western Canada. The 300 megawatt (MW) facility began supplying power in 2014. This project contributes significantly to Alberta's near-term GHG emissions reduction estimates, and is expected to contribute a reduction of 3.7 megatonnes by 2020.

GRAND CHALLENGE: INNOVATIVE CARBON USES PROJECTS

HUMASORB-L

ARCTECH captures CO_2 using a unique liquid absorbent derived from coal that converts the captured carbon into a solid water filter product. The absorbent removes NOx, SOx and toxic trace metals from GHG emissions and can also remove multiple types of contaminants from wastewater.

39 PROJECTS COMPLETED THIS YEAR

CARBON CAPTURE AND MINERALOGIC SEQUESTRATION

Blue Planet has created usable green building products that contain sequestered CO_2. Their solution provides a more efficient cost-effective method for CO_2 emission control for cement, power and petrochemical industries. It also creates a flexible primary raw material and a range of marketable end-use building materials. The process uses natural water and wastewater along with CO_2 to produce a solution that is rich in bicarbonate ions. This solution could be used to produce a large variety of concrete building materials. These building materials also have an emission control service component for refineries, cement plants, and natural gas and coal-fired power plants.

HIGH-EFFICIENCY CAPTURE USING NOVEL FIBRES IN THE PRODUCTION OF SOIL CONDITIONING AGENTS POLYMER REPLACEMENTS

CCm Research has created a unique process that fixes CO_2 to base fibre materials to be used for soil conditioners, fertilizers and other polymers. The process delivers a highly efficient permanent capture of CO_2 and creates high-demand products that can help create a positive long-term environmental impact.

PRODUCTION OF DIMETHYL CARBONATE FROM CAPTURED CO_2 AND METHANOL

E3Tec Service developed a safer alternative to produce dimethyl carbonate (DMC) using CO_2 sequestration, rather than the toxic chemical procedure currently in use. A highly sought-after product used in the manufacture of polycarbonates, DMC can be used to produce solvents, fuel additives and lithium ion batteries. The process employed is energy efficient, environmentally responsible and flexible enough to adapt to a variety of CO_2-emitting industries, regardless of location.

VALORIZING INDUSTRIALLY PRODUCED CO_2: CARBON CAPTURE AND ITS CONVERSION TO MARKETABLE PRODUCTS

Enerkem's goal was to produce fuels and chemicals that are useful at the location where they are generated. As part of this strategy, they developed a technology to convert CO_2 into syngas (hydrogen and carbon monoxide) using a catalytic conversion. With the ability to create syngas at varying ratios, Enerkem can produce a variety of intermediary chemicals that lead to high-value chemical products. This makes the technology useful in regions where transportation or storage costs are prohibitive.

CO_2 TO GRAPHENE REACTORS

Carbon Upcycling Technologies developed a technology that captures CO_2, combines it with graphite and converts it into graphene. The technology required is small and easily implemented by producers with high CO_2 emissions from a variety of industries. The graphene product created from the process is a brand new family of nanoparticle. Its uses, which are continually being developed, represent significant potential.

CONVERTING CO_2 INTO CHEMICALS AND FUELS USING CLEAN, DOMESTIC SOURCES OF ENERGY IN ALBERTA

With the ability to create valuable organic chemicals from CO_2 emissions using renewable energy sources, Liquid Light's process provided an alternative revenue source for CO_2-emitting industries. Liquid Light believed that industries could potentially produce more than 60 different organic chemicals that contribute to producing consumer goods such as water bottles or materials such as polyester. Unfortunately, Liquid Light ceased operation after submitting their final report to CCEMC.

USE OF CO_2 IN MAKING CARBONATE-BOND PRECAST CONCRETE PRODUCTS

McGill University developed a process that uses CO_2 to produce an artificial aggregate to be used in concrete. Because of the unique properties of carbonated concrete, the end product is stronger and more durable than traditional concrete products. This process can be deployed anywhere, and will contribute to the global reduction of CO_2 emissions.

CHEMICAL TRANSFORMATION OF CO_2 VIA SOLAR-POWERED ARTIFICIAL PHOTOSYNTHESIS

Another McGill project involved designing a CO_2 transformation system that represents a completely new approach to carbon capture. Using direct sunlight, CO_2 and water, they developed a process using a unique nitride nanowire technology to chemically transform CO_2 into commercially valuable products including methane (CH_4), hydrogen (H), oxygen (O_2), and methanol (CH_3Oh). This photocatalyst enables an ultra-high conversion efficiency and presents an elegant closed-loop solution for CO_2 and wastewater.

SODA ASH AND BICARBONATE FROM A LOW-ENERGY NATURAL GAS SWEETENING PROCESS

Using an energy-efficient natural gas purification process, New Sky's project converted CO_2 and hydrogen sulphide (H_2S) contaminants from sour gas into valuable commodity chemicals including soda ash, bicarbonate and sulphur. The process uses a non-toxic, water-soluble base to capture CO_2 and H_2S, leaving pure natural gas for use as a low-carbon fuel. Instead of venting the CO_2 from sour natural gas into the atmosphere, New Sky's process puts that CO_2 to use as carbonates to manufacture glass, paper and dozens of other everyday products.

39 PROJECTS COMPLETED THIS YEAR

CONVERSION OF INDUSTRIAL CO_2 EMISSIONS INTO BIOFUELS AND CHEMICALS

Oakbio developed a biomanufacturing platform that converts CO_2 into chemicals at a commercial scale. Oakbio's approach uses a novel microbial system to convert industrially emitted CO_2 into bioplastics, animal feed and other chemicals. For the Grand Challenge, Oakbio partnered with the F.R. Tabita Laboratory of Ohio State University to engineer flue gas-consuming micro-organisms to produce n-butanol, a valuable chemical feedstock and an effective renewable liquid transportation fuel. By bubbling industrial flue gases and hydrogen through a bioreactor, Oakbio can grow its proprietary microbes that consume CO_2 and, in turn, secrete butanol. The butanol can then be continuously separated from the bioreactor culture.

HIGH-VALUE CHEMICALS AND LIQUID FUELS FROM CANADA'S CO_2 AND FLARE GAS EMISSIONS

Pioneer Energy developed a process to create butanol from GHGs. The innovative process addresses key production issues facing other alternative fuels, including development of an economical and reliable production process. Pioneer created a liquid-fuel substitute for gas and diesel from GHG emissions. It works by combining CH_4 with the CO_2 in a unique thermochemical process to produce both high-value synthetic chemicals and liquid fuels. The process can use significant amounts of GHGs from a variety of sources, including flare gas, with the GHG converted to liquid fuels, polymers and industrial chemicals for commercial use.

GREEN METHANOL FROM CO_2 AND RENEWABLE HYDROGEN (METHANOL+)

Innovating in two major areas, Quantiam Technologies developed a technology (Methanol+) to combine hydrogen and CO_2 to produce methanol. The first innovation came from a catalyst database that helps increase efficiency gains, while the second innovation was the generation of hydrogen with environmentally sustainable methods. This process delivers a high-value chemical with a large market and a variety of applications.

CAPTURED-CO_2 CATALYST FOR THE PRODUCTION OF ETHYLENE OXIDE (C3-PEO)

RTI International developed a process to use the oxygen in CO_2 to convert the CO_2 into useful chemical feedstock. With an environmentally responsible and economically sound process that consumes large amounts of CO_2, the primary products created are sought after in the chemical industry to make products like ski boots and fishing rods. The process could be integrated into existing petrochemical infrastructure in Alberta and around the world.

SKYONIC SKYCYCLE PILOT DEMONSTRATION

Skyonic's SkyCycle carbon capture technology used waste heat from the source—a CO_2-emitting plant—to mineralize CO_2 emissions from that plant. SkyCycle used a synthetic base to capture the mildly acidic CO_2, and mineralized it as a solid carbonate. The primary profitable product from the proposed Canadian SkyCycle Plant is hydrochloric acid (HCL).

SOLIDIA CONCRETE—A SUSTAINABLE METHOD FOR CEMENT PRODUCTION AND CO_2 UTILIZATION

Solidia Technologies produces a new form of concrete—Solidia Concrete—that reduces the carbon emissions footprint associated with the production of cement and the use of cement in concrete products by up to 70%. The technology is based on cement designs and curing technologies jointly developed by Solidia, Rutgers and the State University of New Jersey.

NOVEL INTERNAL DRY REFORMING SOLID OXIDE FUEL CELL TECHNOLOGY FOR CO_2 UTILIZATION

The University of Alberta developed a fuel cell that can combine natural gas, CO_2 and air to produce carbon monoxide (CO), water and electricity. Where traditional conversion methods consume energy, this reaction creates it. It also creates water and CO, an important and profitable commercial chemical.

A COUPLED CO_2 AND WASTEWATER TREATMENT PROCESS TO CREATE HIGH-VALUE GAS/OIL FIELD CHEMICALS

The University of British Columbia developed a technology that used CO_2 to desalinate industrial wastewater, creating a smaller carbon footprint and an economical alternative to conventional desalination technology. The process uses these inputs to create desalinated water and high-value chemicals that are particularly useful for the oil and gas industry.

CO_2 CONVERSION TO METHANOL THROUGH BI-REFORMING

The University of California Riverside created an innovative catalyst to be used in the conversion of CO_2 and methane (CH_4) to produce methanol—a valuable fuel and an intermediary chemical. This catalyst makes improvements on catalysts currently available, but can still be adopted for use by conventional processes currently in operation.

MICROALGAE-BASED CARBON SEQUESTRATION SYSTEM

The University of Maryland project used microalgae to mitigate CO_2 from an industrial air source. They harvest the algal biomass to produce biofuels, lutein and other byproducts. The process takes place in a facility housing large photo bioreactors. They believe this technology can work in any climate.

BIOLOGICAL PROJECTS

PROTOCOL VALIDATION STUDIES

This project, by Prasino Group, conducted Protocol Validation Studies (PVS) on two offset protocols, *Beef Reduced Age to Harvest* and *Nitrous Oxide Emissions Reduction.*

The Alberta agriculture sector has several offset protocols for generating credits from avoided GHG emissions under the Alberta Offset System; however, few of the agricultural protocols have been adopted by project developers. These Protocol Validation Studies were intended to provide a learning tool to move early adopters, aggregators and verifiers past barriers that exist in implementing projects under these protocols, and to help them in designing scalable approaches to adopting these protocols to optimize GHG reductions.

INCORPORATING WETLAND CARBON VALUES INTO SPATIALLY EXPLICIT TOOLS TO INFORM LAND USE DECISIONS

Wetlands, which are some of the most productive ecosystems on the planet, store approximately 25–35% of the world's terrestrial carbon. Their value as carbon sinks means that it's important to determine the amount of carbon currently stored in remaining wetlands, and to predict potential carbon losses that are released as GHGs through a depletion of soil organic carbon due to industrial activities and wetland drainage. This project, from Ducks Unlimited, developed a spatially explicit map, at a scale useful for land use planning of wetland carbon distribution, throughout the Prairie Pothole Region and in large portions of the Boreal and Taiga Plains.

SUSTAINABLE REMEDIATION OF PETROLEUM HYDROCARBONS (PHCS) USING PHYTOTECHNOLOGIES

Soil can become contaminated with petroleum hydrocarbons (PHCs) as a result of accidental spills and improper waste disposal, and cleaning the contaminated soil is typically time-consuming and expensive. In addition to GHG emissions directly related to the contamination, traditional cleanup strategies generate additional emissions as a result of both disturbing the soil and transporting it for disposal. This project, from Queen's University, tested an option that involves planting native trees and plants in contaminated soil to encourage the growth of petroleum-eating bacteria. Mixing biochar into the soil helps the plants grow faster, and reduces GHG emissions from organic decay. The project tested native plants and biomass in a greenhouse in preparation for field testing in Alberta.

COMMERCIALIZATION OF BIO-BASED SPRAY FOAM

With funding from the CCEMC, Sprayfoam developed, tested and pre-commercialized a spray foam insulation that incorporates renewable materials from the agricultural sector, instead of using fossil fuels. The project team used bio-based components derived from canola or other plant oils that have been developed by the Lipid Chemistry Group at the University of Alberta.

ADAPTATION PROJECTS

BIODIVERSITY MANAGEMENT AND CLIMATE CHANGE ADAPTATION

This collaborative climate change adaptation project involved a team of biodiversity scientists and policy analysts from the University of Alberta, the Miistakis Institute, Alberta Innovates Technology Futures, the Government of Alberta, and the Alberta Biodiversity Monitoring Institute. The team assessed hundreds of wild species ranging from prairie flowers to backyard birds, and devised proactive strategies for preventing or reducing harm from climate change. The group's findings have been shared broadly; this has expanded the available data, which measures and reports on the status and trends of hundreds of species and habitats at permanent terrestrial and wetland monitoring sites across the province.

TREE SPECIES ADAPTATION RISK MANAGEMENT PROJECT

CCEMC provided funding to the Tree Species Adaptation Risk Management Project to explore the impact of weather extremes on forest regions. The climate change adaptation project saw climate variations replicated through strategic plantings at test sites of species from other regions of the province (for example, northern species in southern Alberta). The knowledge gained is crucial to the province's forest industry as well as for the species that depend on forest environments. Led by the Foothills Research Institute and Tree Improvement Alberta, the three-year project involved a consortium of 13 industry partners, as well as Alberta Environment and Parks.

39 PROJECTS COMPLETED THIS YEAR

The following projects, which were completed in the 2015/2016 fiscal year, were mentioned in our 2014/15 annual report as a subsequent event, due to completion prior to the approval of the report.

REMVUE/SLIPSTREAM AIR/FUEL RATIO CONTROL AND VENT CAPTURE PROJECT

The energy efficiency project led by Cenovus involves installing two distinct efficiency technologies in select engines: the REMVue air/fuel ratio controllers, and a Slipstream vent-gas injection controller. Combined, the technologies will significantly reduce fuel usage, natural gas and GHG emissions.

ENERGY FOOTPRINT REDUCTION FOR ETHYLENE MANUFACTURING

This energy efficiency project by NOVA aimed to improve separation processes in ethylene manufacturing by developing innovative micro-porous molecular sieves that separate similar hydrocarbon molecules. Ethylene manufacturing gas separations consume energy to condense and boil hydrocarbon mixtures. The energy consumed in molecular sieve separation is inherently lower, significantly reducing GHG emissions in ethylene manufacturing.

WHITECOURT RECOVERED ENERGY PROJECT

NRGreen installed a waste heat recovery generation system on a compressor site to produce 13.8 MW of power. Waste heat recovery units capture the exhaust from natural gas turbines and convert it into emissions-free electricity. This was the first installation of the system and there were some challenges. The application of the lessons learned will assist in a successful field execution, commissioning and start-up for future projects.

VENT GAS CAPTURE FOR ENGINE FUEL USE

Encana installed SlipStream technology, which captures methane currently being vented into the atmosphere. This process redirects natural gas and uses it to help fuel the compressor—meaning more fuel is recovered and less GHGs are emitted. This project is one of the first field implementations of this technology. If a wider application of this energy-efficiency technology is implemented, it could have a significant impact on North America's GHG emissions.

ENZERGY THE NEXT GENERATION COAL COMBUSTION FOR CLEANER ENVIRONMENT

This field trial by B&C Energy Services was expected to reduce GHG emissions by improving combustion and thermal efficiencies of burning coal while reducing flue gas emissions and fuel costs. The field trial identified a number of challenges that resulted in shortfalls with the technology. The application of the lessons learned will assist future projects.

LOW-ENERGY-PRODUCED WATER TREATMENT

With the CCEMC funding, Saltworks developed and tested a waste heat-driven desalination technology intended for treating highly impaired waters in Alberta's oil sands industry. The technology uses waste heat, which is abundant in the oil sands, to produce fresh water from SAGD blowdown water. The results are reduced wastewater discharge, reduced freshwater withdrawal and reduced carbon emissions, compared to conventional treatment technologies.

ADDITIONAL PROJECTS

Three projects were completed subsequent to the 2015/16 year-end.

COMPANY-WIDE ROLLOUT OF A SYSTEMATIC ENERGY EFFICIENCY PROGRAM

ConocoPhillips implemented 10 different technologies to help set the standard for industry best practices in GHG emission reduction technologies. Results were shared industry wide and ConocoPhillips was the recipient of an Alberta Emerald Award in 2016 for Implementing and Sharing Energy Efficiency Innovation.

SLAVE LAKE PULP BIO-METHANATION PROJECT

This bio-methanation project involved integrating an energy-efficient anaerobic digestion system into the mill's existing wastewater treatment system. The low-rate anaerobic treatment system, which is believed to be the first in Canada for the pulp and paper sector, provides an opportunity to showcase this renewable energy technology.

GROWTEC ON-FARM WASTE TO RENEWABLE ENERGY TECHNOLOGY

GrowTEC developed an anaerobic digester to create renewable energy. The facility showcases waste diversion and renewable energy generation using commercialized farm-scale technology. The project produced valuable information about the benefits and challenges of farm-scale anaerobic digestion. It diverts waste from landfills and provides enough base load renewable energy to the grid to supply over 700 homes.

2015/16 AUDITED FINANCIAL STATEMENTS

In our mission to fund innovative solutions that result in meaningful greenhouse gas reductions in Alberta and contribute to a lower carbon world, a pivotal component of our success is effectively utilizing the money granted to us through the Climate Change and Innovation Fund (CCEMF) to fund projects that make a difference.

We are leveraging our strengths to contribute to critical climate change innovation priorities in Alberta.

Climate Change and Emissions Management (CCEMC) Corporation

Financial Statements
May 31, 2016

Deloitte.

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Independent Auditor's Report

To the Board of Directors of
Climate Change and Emissions Management Corporation

We have audited the accompanying financial statements of Climate Change and Emissions Management Corporation, which comprise the statement of financial position as at May 31, 2016, and the statements of changes in net assets, operations and cash flows for the year then ended, and a summary of significant accounting policies and other explanatory information.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with Canadian accounting standards for not-for-profit organizations, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditor's Responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with Canadian generally accepted auditing standards. Those standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion

In our opinion, the financial statements present fairly, in all material respects, the financial position of Climate Change and Emissions Management Corporation as at May 31, 2016, and the results of its operations and its cash flows for the year then ended in accordance with Canadian accounting standards for not-for-profit organizations.

Deloitte LLP

Chartered Professional Accountants, Chartered Accountants
September 21, 2016

Climate Change and Emissions Management (CCEMC) Corporation

Statement of Financial Position

As at May 31, 2016

	2016 $	2015 $
Assets		
Current assets		
Cash	268,044,991	296,768,566
Accounts receivable	848,912	5,041,685
Interest receivable	275,502	343,465
Prepaid expenses	1,698	1,972
	269,171,103	302,155,688
Non-current assets		
Capital assets	3,178	-
	269,174,281	302,155,688
Liabilities		
Current liabilities		
Accounts payable and accrued liabilities	3,237,442	5,691,133
Net Assets		
General Fund – unrestricted	-	-
Restricted Fund (note 3)	265,936,839	296,464,555
	269,174,281	302,155,688

Commitments and guarantees (note 6)

Approved by the Board of Directors

J Edendall _____ Director

Robert Mansell _____ Director

The accompanying notes are an integral part of these financial statements.

Climate Change and Emissions Management (CCEMC) Corporation

Statement of Changes in Net Assets

For the year ended May 31, 2016

			2016	2015
	General Fund $	Restricted Fund $	Total $	Total $
Balance – Beginning of year	-	296,464,555	296,464,555	282,128,635
(Deficiency) excess of revenue over expenses for the year	-	(30,527,716)	(30,527,716)	14,335,920
Balance – End of year	-	265,936,839	265,936,839	296,464,555

Climate Change and Emissions Management (CCEMC) Corporation

Statement of Operations

For the year ended May 31, 2016

	General Fund $	Restricted Fund $	2016 Total $	2015 Total $
Revenue				
Grant revenue (note 4)	-	-	-	50,000,000
Interest income	-	3,465,228	3,465,228	4,446,374
	-	3,465,228	3,465,228	54,446,374
Project expenses (note 6)	-	27,992,007	27,992,007	33,034,492
(Deficiency) excess of revenue over project expenses	-	(24,526,779)	(24,526,779)	21,411,882
Operating expenses				
Program management (note 5)	-	4,310,124	4,310,124	5,628,589
Consulting contracted services	-	1,376,399	1,376,399	1,066,416
Corporate costs	-	193,192	193,192	227,212
Amortization	-	636	636	-
Board remuneration and expenses (note 5)	-	60,806	60,806	72,805
Outreach	-	5,500	5,500	28,306
Professional fees	-	43,679	43,679	42,396
Insurance	-	10,601	10,601	10,238
	-	6,000,937	6,000,937	7,075,962
(Deficiency) excess of revenue over expenses for the year	-	(30,527,716)	(30,527,716)	14,335,920

Climate Change and Emissions Management (CCEMC) Corporation

Statement of Cash Flows

For the year ended May 31, 2016

	2016 $	2015 $
Cash provided by (used in)		
Operating activities		
(Deficiency) excess of revenue over expenses for the year	(30,527,716)	14,335,920
Amortization	636	-
Net change in non-cash working capital items		
Decrease (increase) in prepaid expenses	274	(222
Decrease (increase) in accounts receivable	4,192,773	(4,761,893
Decrease in interest receivable	67,963	59,794
(Decrease) increase in accounts payable and accrued liabilities	(2,453,691)	1,658,261
	(28,719,761)	11,291,860
Investing activities		
Purchase of capital assets	(3,814)	-
(Decrease) increase in cash during the year	(28,723,575)	11,291,860
Cash – Beginning of year	296,768,566	285,476,706
Cash – End of year	268,044,991	296,768,566

1 Organization

Climate Change and Emissions Management (CCEMC) Corporation (CCEMC) is an Alberta based, independent, not-for-profit organization incorporated under the Canada Corporations Act on February 17, 2009; its operations commenced on June 1, 2009. CCEMC's mandate is to reduce greenhouse gas emissions and adapt to climate change by supporting the discovery, development and deployment of clean technologies. The Climate Change and Emissions Management Fund (the Fund) was established under the Climate Change and Emissions Management Act by the Government of Alberta to support investment in innovation and clean technologies that will reduce Alberta's greenhouse gas emissions and improve its ability to adapt to climate change. The Fund provides the primary source of revenue for CCEMC. As a not-for-profit organization, CCEMC is exempt from tax in accordance with Section 149(1)(l) of the Canadian Income Tax Act.

2 Summary of significant accounting policies

These financial statements have been prepared by management in accordance with Canadian accounting standards for not-for-profit organizations (ASNPO) within the framework of the accounting policies summarized below.

Fund accounting

For financial reporting purposes, the accounts have been classified into the following funds:

- General Fund

  The General Fund includes all resources available for immediate purposes and accounts for CCEMC's activities other than those directly attributable to funding innovation and clean technologies and adaptation to climate change.

  The General Fund includes all unrestricted monies received that are available for use at the CCEMC's discretion.

- Restricted Fund

  The Restricted Fund includes those funds that are to be used to support investment in innovation and clean technologies and adaptation to climate change.

Revenue recognition

These financial statements have been prepared using the restricted fund method of accounting for contributions, the key elements of which are:

- Unrestricted contributions are recognized as revenue in the General Fund when received or on becoming receivable if the amount to be received can be estimated and collection is reasonably assured.
- Externally restricted contributions are recognized as revenue in the Restricted Fund when received or receivable if the amount to be received can be estimated and collection is reasonably assured. Externally restricted amounts can only be used for the purposes designated by external parties.
- Investment income earned on contributions subject to external restrictions is recorded as revenue in the Restricted Fund in the year it is earned.

Financial instruments

Financial assets and financial liabilities are initially recognized at fair value less transaction costs when CCEMC becomes a party to the contractual provisions of the financial instrument and subsequently are measured at amortized cost with any changes recorded in the statement of operations. CCEMC currently does not hold any equity instruments that would be measured after initial recognition at fair value.

Cash

Cash consists of cash on deposit.

Capital assets

Capital assets are recorded at cost less accumulated amortization. Capital assets are amortized over their estimated useful lives of 36 months using the straight-line method.

Project expenses and liabilities

Project expenses and the associated project liability (included in accounts payable and accrued liabilities) are recognized on receipt of a valid project progress report and associated milestone invoices by CCEMC. A commitment for a project expense is disclosed as such when a contribution agreement is executed.

3 Restricted Fund

The Restricted Fund consists of funds that are externally restricted by the Government of Alberta for the purpose of investing in various initiatives and projects relating to one of the four strategic investment areas: conservation and efficiency, carbon capture and storage, greening energy production and adaptation and knowledge. The funds are also restricted for the purpose of administering CCEMC, which includes fees, expenses, liabilities and other costs.

4 Grant revenue

Funds are granted from the Government of Alberta to CCEMC on an annual basis through the Grant Agreement dated March 31, 2009 (Grant Agreement), which was effective through to June 30, 2015. The Grant Agreement was amended on March 30, 2010 and was further amended on August 8, 2014. The Government of Alberta announced the New Climate Leadership Plan in April 2016, however the details of any new funding arrangement with CCEMC have not yet been determined. The Annual Grant amount for fiscal 2015 was determined on the provincial year-end and is based on the amount contributed to the Fund in the previous compliance year. No grant monies were received during fiscal 2016.

Annual grant amount	**2016** **$**	**2015** **$**
March 31, 2014	-	50,000,000

5 Board and management remuneration

Total honoraria and expenses related to the directors of the board were $59,918 (2015 – $72,241) in the fiscal year. Remuneration paid to directors or their employers includes honoraria totalling $39,893 (2015 – $45,243) as follows:

	2016 $	2015 $
D. Beever	5,259	2,937
R. Blackwood (a)	-	-
J. Carter	1,417	782
P. Clark	7,618	10,776
J. Doucet	3,397	1,892
I. Evans	3,458	6,354
C. Fischer (b)	-	2,155
S. Flint (c)	-	-
B. Kenny	3,336	1,441
D. Lewin (d)	-	9,135
R. Mansell	4,241	2,932
P. Mohr	1,236	-
E. Newell (e)	-	1,752
L. Rosen (e)	-	-
K. Sendall (f)	5,418	1,822
S. Snyder (g)	-	-
A. Tasker	4,513	3,265
D. Wicklum	-	-
	39,893	45,243

a) Appointed September 2014
b) Term expired June 2015
c) Resigned September 2014
d) Resigned June 2015
e) Resigned December 2014
f) Appointed December 2014
g) Resigned February 2016

Of these amounts, $11,385 (2015 – $2,009) is included in accounts payable and accrued liabilities. Expenses paid to directors of $20,025 (2015 – $26,998) relate to reimbursements for meals, travel and accommodation.

Program management expenses include remuneration to contract management who report directly to the board, totalling fees of $4,310,124 (2015 – $5,628,589); of this amount, $504,225 (2015 – $307,049) is included in accounts payable and accrued liabilities.

6 Commitments and guarantees

During the year, contribution agreements for CCEMC funding were executed for seven projects. Also during the year, two of the executed contribution agreements were cancelled. As at May 31, 2016, CCEMC has 94 executed contribution agreements outstanding and has commenced or completed funding for 86 of these approved projects. Total committed funds for executed projects is the difference between the total funding approved for executed contribution agreements and project expenses incurred to date or contribution agreements cancelled. A summary of these amounts is outlined as follows:

	2016 $	2015 $
Total committed funds for executed projects – Beginning of year	94,044,030	126,543,375
Total funds for executed projects approved or adjusted during the year	14,176,060	12,486,728
Project expenses incurred during the year	(27,992,007)	(33,034,492)
Contribution agreements cancelled during the year	(11,849,029)	(11,951,581)
Total committed funds for executed projects – End of year	68,379,054	94,044,030

As at May 31, 2016, funding for eight of the 94 executed projects has not commenced. Funds allocated to the executed contribution agreements are subject to CCEMC's review and approval prior to disbursement to ensure full compliance with the terms of the contribution agreement. The actual financial commitment could therefore differ materially from $68,379,054 but will not exceed that amount.

There are also an additional eight projects, totalling $112,643,300 (2015 – $153,518,299), that have been approved for funding by CCEMC's board of directors but for which contribution agreements have not yet been executed.

Subsequent to year-end, one of the approved projects, totalling $11,500,000, has been cancelled, and two of the approved projects, totalling $24,997,000, have executed contribution agreements. As at September 21, 2016, the CCEMC has five projects remaining, totalling $76,146,300, that have been approved for funding by CCEMC's board of directors but for which contribution agreements have not been executed.

CCEMC indemnifies its directors against claims reasonably incurred and resulting from the performance of their services to the CCEMC. No amounts are reflected in the financial statements related to these indemnifications.

7 Financial instruments

CCEMC's financial instruments are exposed to certain financial risks, including credit risk, market risk and liquidity risk.

Credit risk

Credit risk is the risk of financial loss to CCEMC if a party to a financial instrument fails to meet its contractual obligations and arises principally from cash and accounts receivable. The maximum amount of credit risk exposure is limited to the carrying value of the balances disclosed in these financial statements.

Management monitors these accounts regularly and does not believe CCEMC is exposed to significant credit risk at the statement of financial position date.

Market risk

Market risk is the risk changes in market prices, such as interest rates, will affect the CCEMC's interest income or the value of the financial instruments held. CCEMC is subject to interest rate cash flow risk arising primarily from fluctuations in interest rates applied to its cash balances, which are subject to floating interest rates.

Liquidity risk

Liquidity risk is the risk the CCEMC will not be able to meet its financial obligations as they come due. Management mitigates liquidity risk by monitoring forecasted and actual cash flows to ensure sufficient liquidity to meet its liabilities. Accounts payable and accrued liabilities are due within the current operating period.

8 Economic dependence

100% of CCEMC's grant revenue is received from the Fund. The loss of this funding would have a material adverse impact on CCEMC's operations and financial position. Should a loss of funding occur, all approved project commitments would remain in effect.

THE LAST WORD

Our world is changing. And in order to keep pace, we need to keep developing innovative technologies that tackle GHG emissions across all industries.

Finding new ways to reduce emissions and utilize carbon is a big step, and the positive results we're seeing proves that we're going in the right direction. Let's create a lower carbon world for future generations.

Let's break through.


CCEMC