



Backgrounder

Climate Change and Emissions Management (CCEMC) Corporation

P.O. Box 3197
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Climate Change and Emissions Management (CCEMC) Corporation announces shortlist for \$10 million in funding

31 SMEs invited to submit full proposals for clean technology projects.

Project Title	Proponent	Project Description (Supplied)
Permanent Sealing of GHG Emitting Wells	Seal Well Inc.	This project will demonstrate that permanent sealing of leaking oil and gas or GHG sequestration wells can be reliably accomplished by utilizing a fusible bismuth-tin alloy, molded in situ, as the well casing and cemented annulus-sealing material. The project will include an authoritative corrosion study of the alloy under GHG sequestration conditions, above-ground materials testing, numerical simulation of the process, and field tests in concert with HiFi Eng's most advanced method available for gas leak detection and monitoring. About 700,000 tonnes CO ₂ equivalent GHG emissions should be reduced in Canada over a 3-year period. Additionally, public liability burden for long-term GHG sequestration well repair will be eliminated.
Optimization of Enzymatic System for CO ₂ Capture from Oil Sands Production	CO ₂ Solutions Inc.	CO ₂ Solutions Inc., working with a leading Alberta oil sands producer, will optimize at bench-scale, a biotechnological innovation for low-cost carbon capture from natural gas combustion emissions. The one-year project will ready the technology for field pilot testing at the oil sands partner's facility. The technology is based on the use of an enzyme that functions in humans for the management of CO ₂ during respiration. The enzyme technology in a gas scrubbing system substantially increases the efficiency of CO ₂ removal from industrial effluent gases. Upon full deployment, the technology has strong potential to provide an economic solution for the large-scale reduction of CO ₂ emissions in Alberta, particularly from in-situ oil sands operations.
Sustainable Carbon Capture and Recycling by Photo-electro-methanogenesis	Carbonitum Energy Corporation	Carbonitum Energy Corporation is a clean technology company focused on developing an improved solution for large industrial emitters of CO ₂ . Carbonitum's Carbon Capture and Recycling (CCR) technology will convert flue stack CO ₂ into methane (synthetic natural gas) using engineered bacteria and sunlight. The methane can then be recycled by the emitter for use as a fuel. Facilities using Carbonitum's technology will reduce their operating costs by converting emissions into fuel using a process that is economical without considering the value of CO ₂ credits generated. This project will focus on the synthetic biology required to improve the conversion rate of CO ₂ to methane to industrially useful levels along with the photon delivery system.



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Project Title

Fort McMurray,
 Landfill Aerobic
 Bioreactor

Proponent

SALT Canada Inc.

Project Description (Supplied)

Landfills are anaerobic by nature, requiring in excess of 100 years to degrade organics. Methane is generated as a byproduct. The aerobic process alters landfill state through homogeneous injection of oxygen (compressed air) and moisture (leachate) via hundreds of vertical wells placed in a grid pattern. Oxygen eliminates anaerobic bacteria. Aerobic bacteria naturally replace anaerobic bacteria. Aerobic bacteria combine oxygen with carbon to produce CO₂ which is 21 times less harmful and anthropogenic. System is computer controlled and monitors methane production, oxygen and CO₂ levels, moisture and temperature. Methane generation ceases almost immediately and the landfill is rendered inert within 3 to 4 years.

Validation Testing and Commercial Feasibility of a Low Energy, Enzyme Catalyzed Process for CO₂ Separation from Natural Gas and other High Pressure Applications

Akermin Inc.

Akermin is developing new technology to significantly reduce the energy consumption associated with the capture of CO₂ from industrial processes. Akermin's core technology stabilizes an enzyme, Carbonic Anhydrase, to accelerate absorption of CO₂ from these processes. By reducing capital and energy requirements, this technology can capture CO₂ at a cost up to 50% lower than the best technologies commercially available. The proposed funding will be used to support validation testing and engineering studies to determine the technical and commercial feasibility of Akermin's technology in high pressure applications.

Engineering and Design of the Natural Gas Dual Fuel Blend System for Heavy Duty Vehicles

Hi-Tec Fuel and Auto Ltd.

Engineering and design of a system that allows heavy duty (13 litre to 15 litre) diesel engines to operate with a blend of natural gas, which reduce fuel costs and GHG emissions.

Catalyzed-Membrane Enhanced Thermal Swing (C-METS) for Low Energy CO₂ Capture

Carbon Engineering Ltd.

Carbon Engineering (CE) is a Calgary-based start-up company commercializing technologies for carbon dioxide capture from ambient air (www.carbonengineering.com). CE's President and primary contact is David Keith (keith@carbonengineering.com). This project will build a pilot plant to test CE's proprietary Catalyzed-Membrane-Enhanced Temperature Swing (C-METS) technology in a fully operational outdoor environment. C-METS offers dramatic cost and energy reductions to existing CCS and air capture designs, which together could offer emissions reductions to Alberta of greater than 50 Mt-CO₂/yr. C-METS produces pipeline-quality CO₂ that can be used for enhanced oil recovery and the production of low life-cycle carbon-intensity liquid fuels.



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Enovex Advanced Solid Adsorption Materials	Enovex Technology Ltd.	Enovex has been synthesizing a number of promising metal organic framework crystals that exhibit very intriguing properties. The first exciting property is that these materials demonstrate strong CO ₂ uptake (2.1 mmol / g) at only 0.5 bars. If this scales properly that would mean there may be no need for compression equipment, eliminating compressor electricity usage; which is the largest creator of cost during the operation of a capture system. Enovex has also been able to optimize the ratio between how well gas is adsorbed and how easy it desorbs. This project will maintain these exciting features and optimize the material for other things such as strong selectivity, high storage capacity, hydrolytic stability, and strong reproducibility.
Energy Storage in Cryogenic Carbon Capture	Sustainable Energy Solutions	Cryogenic Carbon Capture (CCC) developed by Sustainable Energy Solutions (SES) captures 90 to 99% of the CO ₂ from a coal fired power plant at lower cost and energy demand than competing technologies. SES proposes an energy storage system in conjunction with CCC that provides 1) effective round-trip efficiencies possibly exceeding pumped storage, 2) a decrease in parasitic losses and supplemental power generation during peak loads, and 3) rapid load following. These system characteristics enable improved grid management and resource utilization of intermittent sources (wind and solar), reduction in new capacity requirements for CO ₂ sequestration, and effective and efficient integrated (coal, natural gas, wind, solar, etc.) energy platforms.
Membrane Process for the Separation of Olefins from Paraffins	Imtex Membranes Corp.	Imtex's project goals are to scale-up and demonstrate its olefin-paraffin separation membrane technology which will greatly reduce energy consumption and related GHG emissions for achieving this separation by 30-90% in light olefins production. Currently, this separation process is the most energy-intensive operation in the production of high volume olefin petrochemicals; the building blocks of plastics production. The technology has been proven and demonstrated with potential customers at lab scale. The project will include construction and operational testing in Alberta of demonstration prototypes that will progressively increase in size from pilot scale to large demonstration scale, leading ultimately to commercialization.



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Alberta GHG Reduction in Cement Manufacturing: Cement Extender Technology	Cementec Industries Inc.	Cement production is very GHG intensive: 0.83 t of CO ₂ is generated per 1 t of cement with some 1.2 M tonnes of locally produced cement required annually in Alberta construction. Cement can be partially replaced by coal fly ash and about 180,000 t of cement is currently replaced (“extended”) by fly ash in Alberta. But only coal fly ash with removed unburnt carbon is suitable as cement extender. This project intends to develop beneficiating treatment of sub-standard Alberta fly ash, making it suitable for replacing additional 150,000 t of cement, reducing Alberta GHG by another 125,000 t annually.
Innovative High Efficiency Engine-Increasing Alberta’s Manufacturing Capacity	E3P Technologies, Inc.	In Alberta’s oil and gas industry, large gas compressor engines burn 60% of the total fuel gas used, emitting 11.9 Mt/year of CO ₂ e. E3P Technologies Inc., an Alberta company is developing a revolutionary engine that can reduce GHG emissions by up to 50% and diversify the Alberta manufacturing industry. E3P has developed the CvRTM, a rotary positive displacement platform technology and a Pulse Detonation Combustor (PDC) that operates with a supersonic detonation of fuel at constant volume resulting in high peak pressures and double the efficiency of an internal combustion engine. A CvRTM compressor and expander will be combined with a PDC to create a high efficiency engine with 1/5 the weight and size of a conventional large HP engine.
Treet	Climate Change Central	Building on energy efficiency and corporate in-reach programs, C3 is launching Treet, an online application that informs individuals about environmental issues and empowers them to take positive action to reduce their environmental impact. Targeting individuals in their household and transportation decisions Treet will provide participants the means to record and track behavioural changes, and provide access to energy efficiency rebates. The development phase of Treet will work with many corporate clients and the city of Calgary to customize options for participants. Treet aggregates the benefits across an organization or community, ensuring behaviour changes generate measurable GHG reductions.



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Waste heat driven water treatment for Alberta's oil sands	Saltworks Technologies Inc.	The project will develop and test a waste heat driven produced water desalination process. The technology could reduce electrical requirements from the current state of 20 kWh/m ³ to 6 kWh/m ³ . If successful, the resulting low cost water treatment process could lower GHG emissions in Alberta's oil sands industry by hundreds of thousands of tonnes per year and offset the need for hundreds of megawatts of power generation. The work has applicability to lower the cost and impact of desalination for SAGD and conventional produced waters, oil sands mine tailings, and industrial waste waters.
Stack Top Temperature Reduction Project	Global Analyzer Systems Ltd.	Global Analyzer Systems Ltd (GASL), intends to demonstrate a technology that continuously measures the oxidation efficiency in high temperature incinerator stacks. There is a clear relationship between the pollutant concentration within the effluent stream and the temperature of the flue gas, which makes a Continuous Emission Monitoring System an ideal instrument for regulating the incineration process. With continuous measurement, sufficient oxidation can be maintained and controlled by making adjustments to the stack temperature (fuel gas to the incinerator). This directly translates to a reduction in energy consumption and a lower emission rate of GHG emissions by 242,000 tonnes per year.
InLine Dewatering of Oil Sands Tailings	InLine Dewatering Ltd.	The InLine Dewatering technology is a newly developed Alberta technology that removes and immediately recycles process heated water from oil sands tailings, whereby sufficient water is re-utilized in the process to minimize the need for large tailings ponds and associated greenhouse (methane) gas emissions. This significant reduction in the storage volume of tailings will positively impact the required number and size of future settling ponds. There is also a corresponding large energy savings and carbon credit component in saving energy required to re-heat the millions of cubic meters of water returned back to process temperatures from tailing ponds.



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V-Pack	VIRO Inc.	<p>VIRO, Inc. is a Calgary-based Canadian company focused on the development and deployment of hybrid power technologies to commercial vehicle markets worldwide. VIRO is currently developing an after-market solution for commercial truck fleet owners. The V-Pack will offer an “options list” of various hybrid components, each one addressing a specific amount of on-board electrical load, reducing the overall fuel consumption and emissions of the vehicle. If all components are selected, fleet companies will get the full hybrid experience. VIRO’s controller will integrate these hybrid technologies to manage renewable power supply to all electrical loads required by class 8 vehicles; hotel, lights, trailer power, and heating/cooling.</p>
<p>Integration of Technologies to Cost-Effectively Reduce GHG and Harmful Emissions from Natural Gas Engine-Compressor Units</p>	REM Technology Inc.	<p>REM Technology Inc. (RTI) has developed and commercialized the REMVue lean engine combustion system and SlipStream® technology allowing use of vented natural gas vapours as engine fuel. RTI now proposes to cut the costs of reducing GHG’s by 40% for owners of natural gas engine-compressor units while meeting existing and expected emission limits. Exhaust gas recirculation and crank- case vapour re-injection, both new technologies, will be integrated with Slip-Stream® by using an innovative engine-compressor control system to produce a world-class product. GHG reductions from this demonstration project will be 2910 tonnes annually with a cumulative total of 6.3 megatonnes over the next 20 years as the technology is rolled out.</p>
<p>LWS Energy Storage Pilot Project</p>	Lancaster Wind Systems Inc.	<p>The LWS Energy Storage Solution Pilot Project (Phase II) will construct and test a scaled prototype of the LWS energy Solution. The prototype (Phase I) has already been commissioned and the Pilot project is the next phase of development. The Pilot project will store energy for use. The LWS system consists of three closed loop systems. The systems use hydraulic pressure to store energy as high-pressurized nitrogen for conversion back to hydraulic energy and then Electrical energy thru hydraulic motors and generators. The ultimate goal is to use this technology in renewable energy applications to store energy and release it when needed thus allowing the renewable energy to be a viable alternative energy requiring no backup.</p>



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NetZero Ready Home Design for Production Housing	Landmark Group of Builders	NetZero Energy Homes combine highly energy-efficient house designs and on-site energy producing technologies to achieve zero energy consumption and zero carbon emissions on an annual basis. Today, NetZero Homes are technically feasible, but are not regarded by the customers and the industry as economically viable due to high front-end costs and lack of ready-to-use solutions. The proposed project aims at developing, validating and demonstrating a cost effective NetZero Ready Home design that can be used in mainstream housing production. The success of the project will help the Alberta homebuilding industry to break the existing barriers to the adoption of NetZero standard and speed up the market diffusion of NetZero homes.
Co-Firing Refused Derived Fuel in Coal Facilities	WastAway Services Canada Inc.	This project is a Win/Win/Win for the Environment, Industry and Municipalities across Alberta. The project involves an innovation that will shift the energy mix in the province of Alberta. The proof of concept includes a new fuel made from municipal solid waste called Refused Derived Fuel (RDF). This project will complete combustion tests at CANMET Energy Technology Centre of Natural Resources Canada. The tests will use ratios of 10% Fluff/ 90% coal and 20% Fluff/ 80% coal. Instead of municipal solid waste (MSW) being trucked to a landfill, it is taken to a WastAway Facility. The facility converts MSW into RDF, which is then sold to a coal burning facility who will co-fire it with coal to create electricity.
Pump Jack Optimization and GHG Reduction using Best Available Technology	Pahl's Preventative Maintenance Corp	The project demonstrates the environmental, operating and economic benefits of upgrading existing pump jacks with best available technology to potentially reduce GHG emissions by 1,170,000 tonnes industry-wide. Fuel gas consumption and GHG emissions will be measured at six units before and after optimization and installation of new state-of-the art control devices. The improvements will be documented and shared with government and industry. The project brings together technology from other jurisdictions and local expertise and shared in a novel manner that will encourage uptake by industry. The advantages include increased oil sales, lower water disposal costs, and lower maintenance costs. The benefits include GHG emission reductions.



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Catalyzed Methane Conversion to Light Olefins and Hydrogen (MtOH): Pilot Demonstration (Laboratory)	Quantiam Technologies Inc.	Alberta's bitumen upgrading industry requires large amounts of hydrogen, whose production currently emits over 10 tonnes of carbon dioxide per tonne of hydrogen produced. Quantiam's MtOH technology represents a disruptive innovation for the bitumen upgrading and petrochemical industries: co-generating light olefins and hydrogen directly from natural gas methane. This enables co-production of a higher value chemical product (olefins) and an increasingly important energy source (hydrogen) from an inexpensive resource (methane). As well as offering a significant economic advantage, MtOH has the potential to dramatically reduce the carbon dioxide emission resulting from hydrogen generation in Alberta by over 8 million tonnes per year.
GTE Solar Inc, Brooks Solar Park	GTE Solar Inc.	GTE Solar Inc plans on developing a 15 MW solar park at Brooks, the first large scale solar park in Alberta. This project will demonstrate that photovoltaic power is the leading sustainable energy solution and is highly accepted by environmentally concerned Albertans. The energy output will be 34000 MWh/year, displacing 44000 tonnes of GHG emissions per year, 1.1 million tonnes over 25 years. Many components will be sourced from Canadian manufacturers and local Brooks vendors will be contracted for site prep, metal work fab, installation and maintenance, totalling over 31000 person-hours. This area was selected for the highest annual PV potential energy levels in Canada. 78 acres of industrial zoned land is secured at Brooks.
GTE Power Corp, Brooks Biomass Power Plant	GTE Power	GTE Power Corp plans on developing a 15 MW biomass power plant near Brooks, Alberta. This project will demonstrate that biomass power has substantial GHG emission reductions and is highly accepted by environmentally concerned Albertans. Energy output of 131,000 MWh/year, displacing 460,000 tonnes of GHG emissions per year, 11.5 million tonnes over 25 years, equivalent to taking 84,000 cars off the road. Local Brooks vendors will be contracted for site prep, installation, building construction and ongoing maintenance. This area was selected for its proximity to a large feedlot. Ten acres of industrial zoned land has been secured at Brooks. This project will bring over 100,000 man hours for development and 30,000 hours per year for operations.



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Alberta Geothermal Energy Technology Roadmap	CanGEA – Canadian Geothermal Energy Association	<p>There is vast geothermal potential distributed in various qualities (high and low cost) across Alberta. For a decade, the government, Universities and Calgary based energy companies have studied the merits of geothermal, primarily based on oil sands applications that demand steam in copious amounts. The present situation can be changed quickly and low cost, renewable, small footprint, distributed energy can finally be deployed using a variety of technologies across Alberta. This Roadmap is the first step in addressing technical and market challenges that if resolved, could lead to significant (> 3 Gt/yr) and economical greenhouse gas reductions in our province.</p>
Growtec	CKP Farms Ltd.	<p>This renewable energy project was initiated by CKP Farms of Chin, Alberta through its wholly owned venture Grow the Energy Circle Ltd. (Growtec). CKP Farms produces large volumes of cull potatoes that will be evaluated as feedstock for anaerobic digestion along with locally available feedlot manure and municipal organic waste. Highmark Renewables is licensing its technology to Growtec, and this will be the first demonstration of its type and scale in Alberta. Market penetration of farm based AD for power generation has been limited due to high capital costs. The project will demonstrate efficient renewable power generation at a smaller (630 kW) scale that has significant roll-out potential for moderately sized farms throughout Alberta.</p>
Community Scale Integrated Renewable Energy Project	Rocky Mountain Power 2006 Inc.	<p>RMP and its partners intend to evaluate the technical capabilities of a new rechargeable battery technology using a first of a kind prototype for a community scale ‘smart grid’ application. Using time synchronized wind and solar generation data, load data from a residential complex and real time battery charge and discharge rates we will demonstrate that an integrated smart grid solution will result in greater use of renewables for residential load and that up to 3400 MW of renewable generation can be added to the generation fleet without compromising system variability. This project will test load and renewable generation variability assumptions to try to optimize the mix of wind, solar and battery capacities with residential load.</p>



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The DF4 Bitumen Extraction Process	CryoEx Oil Ltd.	CryoEx Oil Ltd. is developing a waterless, solvent-free, oil sands bitumen extraction process with tremendous economic and environmental benefits. It will significantly reduce GHG emissions, improve oil sands recovery cost and capital risk structure, reduce environmental impact via a much reduced mine footprint, and speed post-extraction land reclamation/remediation activities through local return of process residuals as fill. With the DF4 process there are: No water requirements; No contaminants; No storage ponds; No tailings ponds. CryoEx's CCEMC-sponsored project will explore technological alternatives for the last two stages of the DF4 process in order to determine the best road towards commercialization.
VeloxoTherm Sorbent Structure Development	InvenTyS Thermal Technologies Inc.	The VeloxoTherm post combustion CO ₂ capture process developed by Inventys is based on adsorption. Sorption separation processes can be intensified (made to be smaller and more efficient) by increasing the adsorption and desorption frequency (heating and cooling) of the process. The extent to which this approach can be implemented is limited by the chemical and physical characteristics of the sorbent reactor. The objective of the project proposal herein is to develop the next generation of structure sorbents for the VeloxoTherm™ post combustion CO ₂ capture process which promise to significantly improve the energy efficiency of post combustion CO ₂ capture.
Low Emission Gasification of Alberta Petroleum Coke	TCG Global LLC	TCG Global proposes a research and development project to study low-emission gasification of petroleum coke for Alberta oil sands upgraders. Currently, pet coke is burned by upgraders to produce heat. TCG proposes to utilize pet coke gasification to deliver Syngas to the upgraders for production of heat and thereby reduce CO ₂ emissions by up to 38%. Through detailed engineering design and software simulations, TCG proposes to validate the CO ₂ emission improvement and further demonstrate the total potential environmental impact to Alberta. TCG has rights to 7 patents for innovative gasification design, and has experience in constructing a commercial scale (175 tonnes/day) gasifier based on this patented technology.