



Round 16 Funded Projects

1. Lead organization: 3XR Inc., Toronto, Ontario

Project title: AmRHEX Technology Development and Demonstration

Environmental Benefits: Clean Water / Climate Change

Economic Sector: Waste Management

Consortium Members:

3XR Inc.
CCI-TBN Toronto Inc.
City of Toronto

Project Description:

As a result of growing concern about water quality, wastewater treatment plants are increasingly required to reduce nitrogen discharges. 3XR has developed a technology that strips nitrogen in the form of ammonia from wastewater and combines it with sulphuric acid to form ammonium sulphate fertilizer. 3XR and its partners will demonstrate the AmRHEX™ technology in a project treating wastewater generated from biogas-producing digesters handling source separated organic waste. The currently recognized ammonia treatment requires large capital expenditure and space for tanks. The 3XR process expects to achieve 60% to 90% ammonia removal using 80% to 90% less energy, one tenth of the space and one half of the cost of the incumbent technology.

2. **Lead organization:** 6574262 Canada Inc. (ICUS), St. John's, Newfoundland and Labrador

Project title: Microencapsulated Biological Inoculant to Reduce Nitrogen Fertilizer Use in Wheat Production

Environmental Benefits: Clean Soil / Clean Water / Climate Change

Economic Sector: Agriculture

Consortium Members :
6574262 Canada Inc. (ICUS)
Advanced Biological Marketing (ABM)
Viterra Inc.

Project Description :

Fertilizer is one of the highest input costs in agriculture. Nitrogen-based fertilizer increases crop yield, but even when applied at optimal levels, only around 50% of the nitrogen is actually taken up and used by the plants. The remaining nitrogen is washed away by surface drainage into water courses, leaches into ground water or decomposes and is released to the air as nitrous oxide, contributing to greenhouse gas emissions. Some may also remain in the soil as a nitrogen-based contaminant. ICUS proposes to demonstrate the pre-commercial production and use of a new patented strain of *Trichoderma* fungi (10TC) that, when applied to wheat seeds, has the potential to decrease chemical fertilizer nitrogen use by 25-40%. 10TC attaches to plant roots and stimulates the release of chemicals that increases the plants ability to efficiently acquire and use available soil nitrogen leading to faster growth, increased plant mass and higher stress tolerance. The improved efficiency of fertilizer use is expected to reduce costs to the farmer by up to \$22/hectare – which would nearly double the farmer's margin based on recent market prices for wheat and fertilizer – while reducing water, soil and air emissions. The treatment also could increase wheat yields by 5-10% depending on nitrogen application rates used in conjunction with 10TC.

3. **Lead organization:** Available Energy Corp., Collingwood, Ontario

Project title: Hydrogen and Heavy Water Production

Environmental Benefits: Clean Water / Clean Air / Climate Change

Economic Sector: Energy Exploration and Production

Consortium Members:
Available Energy Corp.
Air Liquide Canada Ltd.
Atomic Energy of Canada Ltd.
Isowater Corp.

Project Description:

Heavy water is used as a coolant and moderator in nuclear reactors, in particular the CANDU technology developed in Canada. The traditional means of producing heavy water, the “Girdler-Sulphide” process (G-S), requires very large amounts of water, is extremely energy intensive, and uses a toxic chemical (H₂S) that is partly released in water and air. Available Energy Corp. proposes to demonstrate a unique process – called D2X™ – for the co-production of heavy water and hydrogen from water electrolysis that is economically and environmentally superior. The D2X™ process “piggy backs” on existing chemical plants to achieve stable, secure and long-term production of heavy water — at attractive cost compared to the G-S process. It is expected to reduce by close to 99% the water requirements and emissions associated with the G-S process.

4. Lead organization: Electrovaya Corp., Mississauga, Ontario

Project title: Advanced Battery System for Plug-In Hybrid Electric Vehicles

Environmental Benefits: Climate Change / Clean Air

Economic Sector: Transportation

Consortium Members:

Electrovaya Corp.
Chrysler Group LLC

Project Description:

High energy and power density batteries are currently viewed as the key to enabling the broad deployment of lower emission and zero emission vehicles. Lithium ion based batteries are generally seen as the most promising battery technology platform for achieving an electric vehicle alternative. Electrovaya is proposing to develop and demonstrate its advanced, high energy density Lithium Ion SuperPolymer® battery packs for applications in a test fleet of plug-in hybrid electric vehicle (PHEV) versions of the Ram 1500 pickup from Chrysler Group’s Ram Truck Brand. Electrovaya’s battery packs have demonstrated the ability to provide greater energy density than competitors using a unique zero-emission cell manufacturing production process with no toxic solvents. The project builds on Electrovaya’s previously-funded SDTC project and includes the development of advanced cells and battery modules, the development of a higher throughput battery cell and module production line, and the lifetime performance validation of battery packs to establish the commercial value of spent automotive packs.

5. Lead organization: EnerMotion Inc., Caledon, Ontario

Project title: Hybrid Auxiliary Power Unit Development and Demonstration

Environmental Benefits: Climate Change / Clean Air

Economic Sector: Transportation

Consortium Members:

EnerMotion Inc.

J.D. Smith & Sons Ltd.

Project Description:

Heavy trucking is involved in almost every part of the Canadian industrial and commercial value chain. It also represents about 10% of total Canadian energy related GHG emissions. On average, heavy freight trucks sit idle six hours per day but engines still run to provide heat, cooling and electrical power to the cab, which translates to 12 per cent of the annual fuel consumed and significant GHG and CAC emissions. To address these issues, EnerMotion has developed the Hybrid Auxiliary Power Unit (HAPU™) which captures waste exhaust heat, solar energy and braking energy, stores it and converts it to useful cooling, heating and electricity that can be used to provide all energy requirements for truck cabs for extended idling times. The HAPU is projected to have a payback period of less than one year for typical long haul trucking.

6. Lead organization: Etalim Inc., Burnaby, British Columbia

Project title: Etalim Thermoacoustic-Stirling Micro Cogeneration Demonstration

Environmental Benefits: Climate Change / Clean Air / Clean Water / Clean Soil

Economic Sector: Power Generation

Consortium Members:

Etalim Inc.

IBC Technologies Inc.

Project Description:

Etalim is developing a new class of small scale (1.5-3 kW) energy conversion device based on thermo-acoustic principles, the Thermal Electric Generator (TEG), which is expected to have electrical conversion efficiency of up to 48% with low equipment cost. The TEG can be fuelled using virtually any high temperature heat source (e.g. concentrated solar, waste process heat, etc.) or combustion fuel (biomass, biogas, syngas, natural gas etc.) The TEG has a simple design, has virtually no moving parts and is made primarily of steel components, lending itself to mass manufacturing techniques, leveraging economies of scale and low maintenance costs. The TEG technology is applicable to a broad range of applications and is planning to be initially demonstrated in micro-combined heat and power applications.

7. Lead organization: Gestion TechnoCap Inc., SpaceWatts Division, Bromont and Varennes, Quebec

Project title: SpaceWatts Utility Scale Grid Parity Solar Energy Project

Environmental Benefits: Climate Change / Clean Air

Economic Sector: Power Generation

Consortium Members:

Gestion TechnoCap Inc., SpaceWatts Division

Arch Aluminum & Glass Co. Inc.

Monast Inc.

Hydro-Québec Research Institute (IREQ)

Université de Sherbrooke

Spire Semiconductor LLC

Project Description:

Concentrating Photovoltaic (CPV) is a critical enabler for utilities who wish to deploy solar electricity generating systems with efficiencies above 25% as compared to low cost un-concentrated thin film PV, which currently achieves 11% efficiencies. Key to the uptake of CPV technology is getting the costs to a competitive level through efficiency and manufacturing improvements. SpaceWatts has developed a utility scale CPV solution that addresses both of these issues through a highly efficient CPV design which marries volume manufacturing techniques with readily available materials and supply chain logistics. SpaceWatts plans to build the first 35kW instrumented unit in Bromont, QC. This will be followed by the demonstration of a 125 kW pilot at Hydro Quebec's Research Institute (IREQ) in Varennes, QC and comparative testing of each unit under Quebec's wide range of weather conditions.

8. **Lead organization:** InvenTyS Thermal Technologies Inc., Burnaby, British Columbia

Project title: VeloxoTherm™ Gas Separation Process

Environmental Benefits: Climate Change

Economic Sector: Energy Exploration & Production

Consortium Members:

InvenTyS Thermal Technologies Inc.
British Petroleum, Plc
Mast Carbon International
Suncor Energy Services Inc.
Doosan Babcock Energy

Project Description:

Carbon Capture and Storage (CCS) is a leading strategy to combat climate change which involves separating carbon dioxide from the gases produced by the combustion of fossil fuels (flue gases). A barrier preventing the widespread adoption of CCS is the economic separation of CO₂ from the flue gases. The VeloxoTherm™ process developed by InvenTyS is a post-combustion capture and separation technology which utilizes a patented process design and adsorbent architecture which greatly reduces CO₂ separation cost. The VeloxoTherm™ process is capable of separating CO₂ from flue gases at 1/3rd of the cost of the leading separation technology for post combustion capture of CO₂ from industrial flue gas streams.

9. Lead organization: InvoDane Engineering Ltd., Toronto, Ontario

Project title: Unpiggable Pipeline Inspection

Environmental Benefits: Climate Change

Economic Sector: Energy Exploration & Production

Consortium Members:

InvoDane Engineering Ltd.
The Northeast Gas Association
Enbridge Gas Distribution Inc.

Project Description:

Current inspection methods for unnavigable natural gas pipelines require the pipeline to be shut down and the gas vented to the atmosphere. InvoDane is demonstrating a technology designed to detect anomalies or weaknesses while the unpiggable pipeline is in service, allowing the pipeline operator to determine the pipe condition and schedule repairs so interruption of the gas service is minimized and venting is avoided. The technology, called Transmission Inspection of Gasmains via Robotic Explorer (TIGRE), consists of robotic linked sections that are self propelled, reversible and use magnetic flux leakage (MFL) sensors to detect anomalies. TIGRE can be launched at any accessible location while the pipeline is under pressure and the robot can change shape to negotiate pipeline features. The technology aims to reduce the number of gas pipeline failures and the associated cost, environmental impact and risk to human safety.

10. Lead organization: Lakeshore EMPC Two L.P., Toronto, Ontario, an affiliate of the Kilmer Brownfield Equity Fund L.P.

Project title: First Full-Scale Application of ZVI-Clay Technology in Canada to a cVOC-impacted Brownfield Property

Environmental Benefits: Clean Soil / Clean Water / Climate Change

Economic Sector: Waste Management

Consortium Members:

Lakeshore EMPC Two L.P., an affiliate of the Kilmer Brownfield Equity Fund L.P.
WNUF Lakeshore L.P., an affiliate of the Whitecastle New Urban Fund L.P.
EnviroMetal Technologies Inc. (ETI)

Project Description:

Many sites on which chlorinated organic solvents have been used — typically former industrial and dry cleaning sites — have residual soil and ground water contaminant issues which are currently difficult to deal with at source locations and which impede future redevelopment. The lack of effective and proven remedial technologies for this source contamination has resulted in the favoured use of the “Dig-and-Haul” approach in Canada, with contaminated soil hauled off-site for landfill disposal. This project will demonstrate the first commercial-scale brownfield remediation application of ZVI-Clay *in situ* treatment, which involves mixing both zero valent iron (ZVI) and clay into soil and ground water contaminated with chlorinated volatile organic compounds (cVOCs) to treat source locations. On-site treatment and material re-use are more sustainable remedial approaches than traditional landfill disposal and clean soil importation. ZVI-Clay will be used to facilitate the remediation of the 10.6-acre brownfield property in Toronto with extensive cVOC contamination in both soil and ground water. Once remediated, this former industrial property will be redeveloped for residential use in conformance with the City of Toronto’s Official Plan. This project intends to demonstrate to the Canadian marketplace and regulators that this technology can effectively address cVOC source contamination and thus enable remediation and site redevelopment on other affected brownfield sites across Canada while promoting more sustainable methods of remediation.

11. Lead organization: Mustard Products & Technologies Inc., Saskatoon, Saskatchewan

Project title: Development & Demonstration of MPT’s Mustard Based Biofumigant

Environmental Benefits: Clean Soil / Clean Water / Clean Air

Economic Sector: Agriculture

Consortium Members:

Peacock Industries Inc.

SePRO Corporation

Ag-West Bio Inc.

National Research Council – Industrial Research Assistance Program

Project Description:

Treatment of turf, vegetables and small fruit crops with synthetic pesticides to improve cosmetic appearance and yield is common practice. However, usage and application of synthetic pesticides can have serious negative environmental impacts. Mustard Products & Technologies Inc. (MPT) aims to design, build and commission Canada's first full-scale manufacturing line for bio-pesticide produced from mustard. MPT's goal is to develop and manufacture biological-based solutions that are natural, renewable and safe to use in managing key pests. The MPT bio-fumigant is anticipated to be an effective biological solution for managing key pests in the initial, high-value turf niche market with application primarily to golf courses, as well as for high value food crops such as strawberries and tomatoes. By developing and demonstrating this sustainable biofumigation technology, MPT is seeking to create a niche market for renewable mustard meal beyond its traditional uses as a condiment or ingredient for the food industry.

12. Lead organization: Ocean Nutrition Canada Ltd., Dartmouth, Nova Scotia

Project title: Demonstration of ONC T 18 B for Biofuel

Environmental Benefits: Climate Change / Clean Air / Clean Water / Clean Soil

Economic Sector: Energy Exploration and Production

Consortium Members:

National Research Council – Institute of Aerospace Research
National Research Council – Institute for Marine Biosciences (NRC-IMB)
UOP LLC (Honeywell)
Lockheed Martin

Project Description:

Aviation fuels represent 12% of the fuel consumption in transportation, and jet fuel use is doubling every ten years. In the search for sustainable alternatives to fossil fuels, algae-based biofuel has shown great promise. Ocean Nutrition Canada (ONC) has discovered a heterotrophic algae — called ONC T 18B — with 60 times the productivity of other algae which can be grown on elemental carbon in closed reactors, without sunshine. ONC intends to build a demonstration fermentation production site to produce algal feedstock oil for biofuels in a meaningful scale and competitive cost. Trials will be conducted to demonstrate that ONC T 18B can be direct replacements for aerospace (biojet) and land transportation (biodiesel) liquid fuels.

13. Lead organization: Phostech Lithium Inc., Candiac, Quebec

Project title: Phostech Lithium P2

Environmental Benefits: Climate Change / Clean Air

Economic Sector: Transportation

Consortium Members:

Phostech Lithium Inc.

Université de Montréal

GAIA Akkumulatorenwerke GmbH

K2 Energy

Auto-Kabel Managementgesellschaft GmbH

Project Description:

The automotive industry is investing heavily in Lithium-Ion battery technologies for Hybrid Electric Vehicle (HEV) applications. Presently, the cathode material used in these batteries is a significant limiting factor in cell performance. While there are several lithium-ion cathode chemistries available, none adequately address thermal management and long operating cycle requirements. Lithium-ion/ Iron Phosphate (LFP) is the leading choice in cathode material for batteries intended for electric vehicles. Phostech Lithium Inc. created a high power density carbon nano-coated LFP cathode material that addresses the safety, cost and charge cycling issues for next generation electric car batteries. The project will focus on a 24 times scale-up from a 100t/y batch pilot plant to a continuous and fully integrated 2,400t/y plant; on producing a consistent quality material from a larger “first of its kind” wet chemical processing unit, and on meeting battery manufacturers’ specifications and price points.

14. Lead organization: Purifics ES Inc., London, Ontario

Project title: SAGD Water Purification for Boiler Feedwater

Environmental Benefits: Clean Water / Climate Change

Economic Sector: Energy Exploration and Production

Consortium Members:

Purifics ES Inc.

Suncor Energy

Project Description:

Steam Assisted Gravity Drainage (SAGD) is the dominant extraction method used for in-situ extraction of bitumen from oil sands. The SAGD process injects steam into underground oil sands deposits, allowing the bitumen to drain out of the sand where it is collected and sent for upgrading. The water from the SAGD operation is contaminated, posing significant technical challenges to maximizing water recycle. Purifics proposes to demonstrate an integrated process using its proven Photo-Cat® technology in a new application on the treatment of SAGD produced water. The process involves ceramic membrane filtration, photo-catalytic oxidation and reverse osmosis to remove suspended solids, dissolved solids and free oil while treating hydrogen sulphide and high molecular weight organics. The result is the more efficient recycling of water to a higher standard, creating the opportunity for more efficient steam production. The technology has the potential to significantly reduce energy use and to increase the overall water recycling rate to greater than 95% using non evaporative technology. It is intended that field piloting will be conducted at Suncor's Firebag facility near Fort McMurray Alberta.

15. Lead organization: Quadrogen Power Systems, Inc., Vancouver, British Columbia

Project title: Co-production of Renewable Electricity, Heat and Hydrogen using Biogas at Nata Farms

Environmental Benefits: Climate Change / Clean Air

Economic Sector: Power Generation

Consortium Members:

Nata Farms Inc.

National Research Council Canada – Institute for Fuel Cell Innovation

FuelCell Energy Inc.

Offsetters Clean Technology Inc.

Project Description:

Quadrogen Power Systems Inc. and its consortium partners will demonstrate the technical and commercial viability of Canada's first renewably-fuelled combined heat, hydrogen and power system, where onsite anaerobic digesters will supply renewable biogas from a dairy farm's manure stream. This project will demonstrate Quadrogen's high performance Integrated Biogas Pre-treatment System and H₂ Booster technologies integrated with an internal reforming fuel cell power plant. It aims to generate up to 300 kW of renewable electricity, 150 kW of heat, 150 kg/day of high purity hydrogen, and have the ability to directly supply greenhouses with clean and high concentration CO₂ exhaust from the fuel cell system. The project aims to demonstrate class-leading efficiency, ultra-low emissions, and a cost-effective distributed generation model that also helps build the hydrogen infrastructure of tomorrow's sustainable energy sector.

16. Lead organization: Spartan Bioscience Inc., Ottawa, Ontario

Project title: Spartan DX-12[®]

Environmental Benefits: Clean Water / Clean Soil

Economic Sector: Energy Utilization

Consortium Members:

Spartan Bioscience Inc.
Maple Leaf Foods
Hanson Technologies
LD Tool & Die

Project Description:

Bacterial pathogens have been linked to over 11 million food borne illnesses in Canada. Dangerous levels of undetected pathogens can lead to outbreaks, recalls and treatment of contaminated food and water. Spartan Bioscience and its partners are developing and demonstrating an integrated genetic analyser capable of detecting pathogens in food and water. Combining Polymerase Chain Reaction with Bacteriophages (human-friendly virus that infect bacteria) and enabling their detection in the same portable instrument will greatly enhance the detection capabilities in food processing (wash water), ground water and ultimately water treatment applications. The integrated unit will be demonstrated in the detection of Listeria, E. coli and Legionella, with expected reductions in time to results from 96 hours to 8 hours. The anticipated benefits include water and soil environmental improvements and better public health from safer processed food, water wells and public water supplies. The portable automated analysis and reporting characteristics make the technology suitable for integration into plant operations (for example wash water in food processing or water treatment), source water field testing and ground water systems in remote and aboriginal communities.

17. Lead organization: Targeted Growth Canada Inc., Saskatoon, Saskatchewan

Project title: Biologic and Process Technologies for Renewable Jet Fuel

Environmental Benefits: Clean Soil / Clean Water / Climate Change / Clean Air

Economic Sector: Agriculture

Consortium Members:

Bombardier Aerospace
Porter Airlines Inc.
Pratt & Whitney Canada
Sustainable Oils, LLC
UOP LLC, A Honeywell Company

Project Description:

The aviation industry is coming under increased pressure to reduce its environmental footprint. Aviation fuels represent 12% of the fuel consumption in transportation and jet fuel use is doubling every ten years. Targeted Growth Canada (TGC) and partners will demonstrate a process utilizing camelina, an oilseed crop, as a feedstock for renewable jet fuel. The project will optimize production and establish performance standards for this first-of-its-kind product in Canada: a drop-in replacement for traditional jet fuel that fits with the current refining and distribution infrastructure and with existing engines. The vertically integrated process takes farmer-produced grain through crushing to a pre-refined vegetable oil. This crude camelina oil is then refined into hydro-treated renewable jet fuel (HRJ). Camelina HRJ provides benefits over traditional petroleum fuel because it reduces GHG emissions — up to 80%, reduces SO₂ and is not competitive with food because it is a hardier crop and can be grown on marginal land. The strategic benefit to farmers is that it grows well on drier land, can make marginal land profitable and is a good rotation crop with wheat.

18. Lead organization: Tenova Goodfellow Inc., Hamilton, Ontario

Project Title: NextGen Energy Efficiency Breakthrough Technology for EAF Steelmaking

Environmental Benefits: Climate Change

Economic Sector: Energy Utilization

Consortium Members:

Tenova Goodfellow Inc.
University of Toronto
ArcelorMittal Dofasco Inc. (AMD)
Tenova SpA
Tenova Re Energy GmbH

Project Description:

The Electric Arc Furnace (EAF) is a highly energy intensive, scrap metal melting process currently producing about one third of the world's steel with a total energy consumption of almost 385 million megawatt hours per annum worldwide. The EAF remains one of the least automated, energy intensive heavy industrial processes largely due to the harsh operating environment that makes sensor reliability and related process monitoring and control extremely difficult. Built on the process modeling developments of a previous SDTC project involving Basic Oxygen Furnace steelmaking, this project aims to demonstrate a comprehensive real-time monitoring and process control system where the EAF is paced according to the total electrical and chemical energy input adjusted for energy losses. The objective is to use an array of advanced sensors and process models to manage the EAF mass and energy balance online. The primary goal of the NEXT GEN EAF is to make a step change of approximately 24% (36 kWh/ton of steel) reduction in EAF energy use and related GHG emissions.