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2013 Annual Report Supplement

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Introduction

In accordance with the terms and conditions of both Funding Agreement Four pertaining to the Sustainable Development Technology Fund (SD Tech Fund™) between Sustainable Development Technology Canada (SDTC) and the Government of Canada, executed August 9, 2012, and the Funding Agreement pertaining to the Next Generation Biofuels Fund (NextGen Biofuels Fund™) between the same parties executed September 4, 2007, SDTC is required to publish an Annual Report Supplement to provide specific additional details of projects funded by SDTC. Within this supplement, SDTC provides the required information relating to both Funds in 2013. SDTC received \$325 million over eight years in Federal Budget 2013 and is currently in negotiations with the Government of Canada on Funding Agreement Five. Some of the funding decisions outlined in this report are conditional upon the signing of Funding Agreement Five.

This Annual Report Supplement, which complements the SDTC Annual Report, is tabled in Parliament along with the Annual Report and the Corporate Plan Executive Summary by the Minister of Natural Resources. These documents are made available to the public on SDTC's website.

Purpose and Selection Criteria of Each Fund

Each Fund has a unique purpose and set of criteria for qualifying, assessing and approving projects. This is summarized in this report, at the beginning of the respective sections, for the SD Tech Fund™ and the NextGen Biofuels Fund™.

Conflict of Interest and Non-Disclosure Requirements for SDTC's Funding Allocation Process for Both Funds

All due diligence and decision making processes at SDTC require that the individuals involved are subject to conflict of interest guidelines and non-disclosure agreements. This is applied consistently whether the individuals are experts reviewing applications or part of the SDTC organization. It should be noted that Directors of the Board are also subject to conflict of interest guidelines that require Directors to declare potential conflicts of interest and refrain from participating in any discussion regarding matters that could give rise to a conflict of interest.

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Section 2: SD Tech Fund™ - Introduction

Purpose

The purpose of the SD Tech Fund™ is to:

- fund the development and demonstration of new sustainable development technologies related to climate change, clean air, clean water, and clean soil in order to make progress towards sustainable development;
- foster and encourage innovative collaboration and partnering amongst diverse persons in the private sector and in academic and not-for profit organizations to channel and strengthen the Canadian capacity to develop and demonstrate sustainable development technologies with respect to climate change, clean air, clean water, clean soil; and
- ensure timely diffusion by funded recipients of new sustainable development technologies in relevant market sectors throughout Canada.

Funding provided by SDTC is a grant provided to Eligible Recipients, subject to the successful completion of contracted milestones.

Eligible Projects

To be eligible, a project must be primarily carried on in Canada to develop and demonstrate new technologies to promote sustainable development, such as:

- technologies related to energy end-use technologies, such as transportation and building technologies, and technologies to reduce ground level ozone;
- technologies related to the hydrogen economy, such as mobile and stationary fuel cells, the production, distribution and storage of hydrogen as well as transition fuels and related technologies;
- technologies related to the sustainable production of fossil fuels (“clean fossil fuel technologies”), such as the efficient combustion or conversion of fossil fuels (including advanced coal gasification), CO₂ capture and storage, more efficient technologies for surface and in-situ oil sands production, and access to frontier and unconventional natural gas resources;
- renewable energy technologies, including biomass, solar, wind, wave and tidal technologies;
- greenhouse Gas emissions reduction technologies related to areas other than energy production and use, including technologies to reduce CO₂ in cement manufacturing;
- air quality improvement technologies, including toxic substance recovery systems, particulate control technologies and acid rain technologies;
- enabling or cross-cutting technologies, including sensors and controls, closed loop process waste, or air, water or soil treatment technologies, and process technologies for the purpose of increasing energy efficiency;

Section 2 – SD Tech Fund™ Introduction

- water quality and quantity improvement technologies, including, the conservation of water and the disinfection and the mitigation or abatement of contaminants in water, sewage or sludges generated in the treatment of wastewater or potable water; including associated equipment for detection, quantification, analysis and calibration;
- waste management technologies, including those designed to prevent, reduce, or eliminate solid waste generation or discharge, as well as materials recovery processes, composting, thermal treatment, and biotechnology-based systems, and associated equipment for detection, quantification, analysis, and calibration;
- soil quality improvement technologies, including the remediation of contaminants in soil and sediments, through containment, removal, recovery, reduced bio-availability, and destruction methods applied either in-situ or ex-situ using physical, chemical, thermal or biological processes, and associated equipment for detection, quantification, analysis, and calibration.

Funding Criteria

The Foundation must only award funding to eligible recipients who demonstrate that:

- the proposed project is technically sound and will, in the opinion of the Board, result in the development or demonstration of new sustainable development technologies;
- the Eligible Recipient brings together the necessary technical, financial and management capacity to successfully undertake the Eligible Project in a collaborative and innovative manner;
- the funding by the Foundation is necessary to ensure that the Eligible Project proceeds within the scope, with the timing or at the location necessary to ensure that significant broad benefits accrue to Canadians nationally or regionally; and
- the Eligible Recipient has provided a description and assumptions for the timely diffusion and deployment in relevant market sectors of the new sustainable development technology resulting from the proposed Eligible Project and any related incremental intellectual property.

More detail on the funding process can be found in the Funding section of the SDTC website at: www.sdte.ca

Section 3: SD Tech Fund™ - 2013 Project Descriptions

This section of the report provides a brief description for each project approved for funding by SDTC's Board of Directors in 2013 (2012B and 2013A) as of December 31, 2013. Those conditionally approved are marked with an asterisk.

Information on the projects completed in 2013, and those reporting on market impacts, can be found in section 3 of this report.

To view SDTC's entire portfolio, along with the ability to sort by geographical location, economic sector, environmental impact or consortium member, please refer to the Results section of SDTC's website (http://www.sdtec.ca/sdtec_projects/index_en.htm).

Round 23 2013A - Board Approval November 2013

Carbon Engineering Ltd.*

Round 23 2013A

Environmental Benefits: Climate Change

Total Project Value:
\$7,987,500
 SDTC Funding:
\$3,000,000
 Leveraged Funding:
\$4,987,500

Direct Air Capture Pilot Plant Demonstration

Carbon Engineering has developed a novel and cost effective Direct Air Capture (DAC) process to extract CO₂ from atmospheric air for use in the production of ultra-low carbon fuels. DAC CO₂ can be utilized for Enhanced Oil Recovery (EOR) or for the production of algal biofuels which can be sold at a premium in markets which have adopted Low Carbon Fuel Standards (LCFS) such as California. It is anticipated that the market for these fuels will rapidly expand as other states and regions adopt similar regulations. DAC can also provide pure CO₂ at the point of demand for other industrial applications. SDTC funds will support the build and operation of a pilot plant that uses the DAC process, a scalable technology that integrates a set of proven industrial processes in a novel configuration. The process absorbs CO₂ into a liquid solution, where it is easier to separate out, producing a pure stream of industrial-grade CO₂ at high pressure, while regenerating the original capture solution. The EOR or algal based fuels made using this technology will have 60 percent lower life-cycle carbon-intensity than those made with conventional processes. DAC technology also enables the future synthesis of sustainable liquid hydrocarbon fuels with zero net carbon emissions.

Consortium Members

Carbon Engineering Ltd.
 Summit Power Group, LLC
 Century Energy Resources
 Trestle Energy, LLC

Cleeve Technology Inc.*

Round 23 2013A

Environmental Benefits: Clean Water / Clean Soil

Total Project Value:
\$2,200,000
 SDTC Funding:
\$710,000
 Leveraged Funding:
\$1,490,000

Environmentally Efficient De-Coating of Aerospace Structures
 Aircraft operate in harsh environments, taking the brunt of storms, extreme climates, and the high-velocity impact of debris. In order to preserve their structural integrity, their protective coatings must be regularly removed and refreshed – a de-coating process that results in hazardous waste. In addition to the environmental hazards, de-coating of aircraft surfaces is a costly process which can constitute 33% to 50% (depending on the aircraft) of the total operating cost for a Maintenance, Repair and Overhaul (MRO) facility. Cleeve Technologies is developing an environmentally-efficient de-coating technology that uses robotics and lasers to remove protective coatings from large, complex aerospace structures. Cleeve’s technology reduces the overall environmental footprint for a de-coating operation by keeping the use of substances of environmental concern to a minimum and, in addition, it is expected to reduce the overall cost of performing these operations by over 86%. The goal of this project is to enable a fully automated process capable of de-coating 95 percent of a medium-sized commercial aircraft.

Consortium Members
 Cleeve Technology Inc.
 BRIC Engineered Systems
 IMP / Cascade
 Boeing Aerospace

Electro Kinetic Solutions Inc.*

Round 23 2013A

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

Total Project Value:
\$6,348,419
 SDTC Funding:
\$2,116,140
 Leveraged Funding:
\$4,232,279

Electro-Kinetic Reclamation of Oil Sands Tailings Development and Field Demonstration
 The oil sands extraction process can result in tailings ponds, bodies of water filled with a mixture of water, clay, sand and residual bitumen. Electro-Kinetic Solutions (EKS) will demonstrate their low-current, electrode array, which will apply an electric field to separate water from oil sands tailings and simultaneously compact the solids. The technology has the potential to reduce the cost of treating tailings while recovering significant amounts of water for re-use. This project will demonstrate that the technology is practical and economically feasible at large scale. EKS estimates that its process could allow oil sands operators to meet stringent tailings reclamation requirements at a lower cost than incumbent approaches and recycle over 200 million m³ of water annually by 2023.

Consortium Members
 Electro Kinetic Solutions Inc.
 Shell Canada Energy

Green Power Labs Inc.***Round 23 2013A****Environmental Benefits: Climate Change / Clean Air**

Total Project Value:

\$5,572,029

SDTC Funding:

\$1,650,000

Leveraged Funding:

\$3,922,029**SolarSatData™ for Buildings Commercial Demonstration**

Commercial buildings in Canada are responsible for 33 per cent of total energy use and emit 35 per cent of the nation's greenhouse gas, with heating and cooling being the largest user. Current automated building management systems (or BEMS) can achieve up to a 14 percent reduction in energy consumption by operating on a rule-based control principle that act on predefined responses for given sets of conditions. Predictive Building Control systems are an emerging best practice in building energy management. They have the potential to achieve additional reduction in energy consumption, however, by only 12% because they utilize low resolution weather forecasting technology (technology that does not provide frequent data and gives that data for a large area). Green Power Labs is developing an advanced predictive building control system for building energy management which uses high resolution climate forecasts – frequent forecasts for a smaller area like a building site – provided by SolarSatData™ for Buildings (SSDB™). SSDB™ is expected to reduce energy consumption in buildings by an additional 7% on top of the 12% energy savings being offered by the emerging predictive building control systems. Green Power Labs' technology could enable a cumulative reduction in emissions of over 72 kT CO₂e/year in Canada and 752 kT CO₂e/year in the U.S. by 2023.

Consortium Members

Green Power Labs Inc.
Dalhousie University
McKinstry Co.
Acadia University

GreenMantra Technologies***Round 23 2013A****Environmental Benefits: Climate Change / Clean Air / Clean Soil**

Total Project Value:

\$6,083,181

SDTC Funding:

\$2,007,450

Leveraged Funding:

\$4,075,731**Catalytic De-polymerization of Recycled Plastics into Waxes**

Wax represents a \$10 billion global industry that has a high dependence on fossil fuels: 94 percent of waxes are derived from petroleum coal and natural gas. One of the major uses of industrial waxes is engineered wood products, the wood boards commonly found in floors, desks and walls. As oil prices go up, so do the prices of these industrial waxes, leaving engineered wood producers seeking new sources of waxes that perform well and also have a lesser impact on the environment and a lower cost. The GreenMantra technology is a catalytic process that converts post-consumer waste plastic (i.e., plastic bags, plastic films or wraps) into higher value products such as waxes, lubricating oils/greases and fuels, resulting in an environmentally-friendly and cost-competitive substitution for petroleum-based waxes. This project will implement the innovative process, enabling the use of low-value recycled plastics to create industry waxes cost-effectively.

Consortium Members

GreenMantra Technologies
Stewardship Ontario
Sylvite Agri-Services Ltd.

Inventys Thermal Technologies Inc.*

Round 23 2013A

Environmental Benefits: Climate Change

Total Project Value:

\$9,492,458

SDTC Funding:

\$3,100,000

Leveraged Funding:

\$6,392,458

VeloxoTherm™ Process Demonstration

The oilsands industry continues to search for carbon capture and storage (CCS) solutions that can reduce their environmental impact in an effective and efficient manner. Inventys Thermal Technologies, along with the consortium members Husky Oil Operations and Howden, are demonstrating the Inventys' VeloxoTherm™ carbon capture process in Lashburn, Saskatchewan. The VeloxoTherm™ uses the company's proprietary structured sorbent, a material designed to attach itself to particular substances, to separate out gasses in post-combustion CO₂ capture. The process promises to deliver superior performance than the incumbent technology. Inventys, in collaboration with its partners, intend to commercialize the VeloxoTherm™ process and deliver the benefits of the technology to Canada's oil sands to reduce their environmental impact.

Consortium Members

Inventys Thermal
Technologies Inc.
Howden Group Ltd.

Morgan Solar Inc.*

Round 23 2013A

Environmental Benefits: Climate Change / Clean Air

Total Project Value:

\$6,265,994

SDTC Funding:

\$2,067,778

Leveraged Funding:

\$4,198,216

Sun Simba™ Gen 4.0 Commercialization Project

The use of solar energy has grown eight-fold over the past five years – a real opportunity for a company developing low-cost components. Morgan Solar is continuing to develop its cutting-edge Concentrated Photovoltaic (CPV) panel, which is twice as efficient as conventional silicon PV panels, and can be manufactured for half the cost. This project will lower the number of parts needed to produce a panel while using a lower-cost material for those parts. Initially designed for utility scale projects – large ground-mounted solar farms – the light-weight and small form factor of the Sun Simba 4 also shows great promise for future rooftop, small scale and off-grid applications.

Consortium Members

Morgan Solar Inc.
Sky Power Global Inc.
University of Ottawa
SunLab

Nemaska Lithium Inc.***Round 23 2013A****Environmental Benefits: Climate Change / Clean Air / Clean Soil**

Total Project Value:
\$40,095,000
 SDTC Funding:
\$12,870,000
 Leveraged Funding:
\$27,225,000

Pilot Demonstration for the Production of High-Purity Lithium Hydroxide and Carbonate

The battery industry has an increasing need for a steady and affordable supply of high-purity lithium hydroxide – a need that is expected to grow by 30% per year over the next decade from 4,500 t to 42,000 t per year. Lithium hydroxide, through the synthesis of the new generation of lithium battery cathode materials increases the stability, reliability and safety of batteries. However, this necessary component, the product of a series of chemical reactions, is more expensive and more difficult to produce than lithium carbonate, the conventional source of lithium for battery manufacturers. Nemaska Lithium has developed a process that reduces the steps required to produce lithium hydroxide at its Quebec-based facility. This project will scale up the process from ~50 kg batches at a time to ~400 t/yr. Nemaska's technology will produce higher purity lithium hydroxide (more than 99.99% as opposed to 99.5% and with very low traces of metallic elements impurities) at a lower cost (33% to 40% lower) as compared to currently-available technologies, while reducing emissions of GHGs and air contaminants.

Consortium Members
 Nemaska Lithium Inc.
 Phostech Lithium
 (Clariant Canada Inc.)
 Sichuan Tianqi Lithium
 Industries Inc.

Orbite Aluminae Inc.***Round 23 2013A****Environmental Benefits: Climate Change / Clean Water / Clean Soil**

Total Project Value:
\$14,043,310
 SDTC Funding:
\$4,500,000
 Leveraged Funding:
\$9,543,310

Red Mud Remediation and Alumina Extraction

Canada is the world's third-largest producer of aluminum. However, production comes at a cost. For every kilogram of aluminum, two kilograms of residual waste are produced, including red mud, which is considered caustic industrial waste. Orbite Aluminae has developed a proprietary process that remediates red mud, converts it into marketable products, including the alumina needed to produce aluminum, in a process that creates virtually no waste. This project will implement the process so as to provide a domestic source of alumina to the Canadian aluminum industry, which is currently importing 100 percent of its needs. Furthermore, compared to the alumina-producing process used today, Orbite's technologies could lower operating capital needed by as much as 30 percent, and operation costs by as much as 50 percent. It could completely remediate toxic red mud, thereby improving land use, and reducing greenhouse gas emissions related to transportation of feedstock over very long distances. Orbite's proprietary process would also be applicable to remediate fly ash, the residue generated in coal-fired power plants, which operate throughout Canada.

Consortium Members
 Orbite Aluminae Inc.
 Veolia Environmental Services

Pure Technologies Ltd.*

Round 23 2013A

Environmental Benefits: Climate Change

Total Project Value:
\$3,015,000
 SDTC Funding:
\$1,000,000
 Leveraged Funding:
\$2,015,000

Innovative and Cost-Effective In-Line Leak Detection Tool for Gas Pipelines

There are more than 3.7 million km of natural gas pipelines in Canada and the United States. Small leaks can grow and lead to pipeline ruptures, causing damage to the environment. The SmartBall is a high-resolution, un-tethered, free-swimming acoustic in-line leak detection tool. Pure Technologies has proven the effectiveness of the SmartBall for water and oil pipelines. This project, supported by SDTC, adapts that technology to pipelines carrying gas by incorporating the ability to detect the acoustic signatures of gas leaks. The tool reports back to the user, allowing for quick detection of the location of the leak, and therefore quick remediation. Based on estimates of current pipeline leaks, Pure calculates that by 2023 over 5.9 kt of CO₂ equivalent GHG emissions can be avoided in Canada and 47.4 kt of CO₂ equivalent GHG in the rest of the world.

Consortium Members

Pure Technologies Ltd.
 Plains Midstream Canada
 City of Calgary
 Alliance Pipeline Ltd.

Saltworks Technologies Inc.*

Round 23 2013A

Environmental Benefits: Climate Change / Clean Air / Clean Water

Total Project Value:
\$7,500,000
 SDTC Funding:
\$2,500,000
 Leveraged Funding:
\$5,000,000

Low Energy, Low Cost Desalination: Oil Sands Demonstration with Global Applications

Steam-assisted gravity drainage – SAGD – uses steam to soften underground oilsands, separating oil and sand. This process is both energy and water intensive, and producers are looking for ways to reduce use. Saltworks Technologies has developed two water treatment solutions that could help: the Multivalent Splitter (MVS) and the SaltMaker Thermal (SMT). MVS is a low-energy chemical free softening process that eliminates some minerals from brackish water (a process known as “softening”) to increase fresh water recovery. SMT harnesses waste heat to separate water normally discarded as part of the SAGD process (“blowdown”) into freshwater and solid salt. These technologies will be integrated into an oilsands facility to demonstrate they can reduce electricity consumption by up to 50 percent, helping Canadian oil companies meet increasingly stringent water usage requirements while reducing the use of chemicals and associated health and safety risks, all with a lower total cost than the conventional technologies used today.

Consortium Members

Saltworks Technologies Inc.
 COSIA

Segetis Canada Inc.***Round 23 2013A****Environmental Benefits: Climate Change / Clean Air**

Total Project Value:
\$83,000,000
 SDTC Funding:
\$15,000,000
 Leveraged Funding:
\$68,000,000

Demonstration scale bio-refinery for Levulinic Acid and downstream products

Plasticizers are a component of plastic that improves the flexibility and durability of many consumer goods; however, many conventional plasticizers are now coming under scrutiny from both regulators and consumers for potential health concerns. Levulinic acid is a naturally-occurring product that could be used to produce plasticizers, but has until now been considered too expensive to manufacture in large volumes. Segetis has developed low-cost processes for producing levulinic acid and plasticizers derived from levulinic acid which have been tested to be safe. The Segetis technology is a rapid thermo-chemical conversion process that produces levulinic acid from a renewable sugar-based feedstock at half the price of conventional processes and at a lower environmental impact. The project will see the construction of a commercial demonstration bio-refinery, a first-of-a-kind facility that will bring together two technologies: one to produce levulinic acid and the other to convert levulinic acid into a bio-based plasticizer. This demonstration facility is the last step towards full-scale manufacturing, marketing and commercialization in Canada.

Consortium Members

Segetis Canada Inc.
 Segetis Inc. (USA)
 Lanxess

Sysgaz Inc.***Round 23 2013A****Environmental Benefits: Climate Change / Clean Air**

Total Project Value:
\$6,688,445
 SDTC Funding:
\$2,205,539
 Leveraged Funding:
\$4,482,906

Demonstration of Biomethane Liquefaction for use as a Transportation Fuel

Sysgaz has developed a technology that transforms methane gas collected from landfills into renewable liquefied natural gas (RLNG). This RLNG could become an important source of energy for the transportation sector in the near term. Sysgaz's unique approach integrates three technologies into a single integrated process. These include a proprietary landfill gas capture system, an innovative gas scrubbing system and a compact and energy efficient cryogenic system which, when combined, produce the liquefied renewable natural gas. When compared to diesel, the use of RLNG could enable a 90% reduction in carbon dioxide emissions which is superior to LNG which itself reduces emissions by 25%. This project will validate both the integrated process and the quality of the RLNG, which will be used to fuel Class 8 trucks to demonstrate overall benefits to heavy transport operators.

Consortium Members

Sysgaz Inc.
 MRC Maria de Chapdelaine
 Transport Doucet et Fils

Verolube Inc.*

Round 23 2013A

Environmental Benefits: Climate Change / Clean Air

Total Project Value:
\$12,143,500
 SDTC Funding:
\$3,994,060
 Leveraged Funding:
\$8,149,440

Commercializing the proprietary ReGen™ technology for Re-refining Used Oil into High Quality, High Value and Environmentally Responsible Lubricant and Fuel Products
 Only 15% of used oil is recycled. Verolube Inc. is commercializing its ReGen™ technology for the refining of used oil into marketable lubricants, diesel fuel, fuel oil and asphalt flux. The technology employs an innovative combination of proprietary technologies with proven conventional processes and equipment. The project will focus on scaling up the technology and modularization, which allows for a more cost-effective simultaneous processing of multiple streams of feedstock, as a last step before commercialization. Thanks to the ReGen™ recycling process, 78 percent less energy will be used to produce new oil, while CO₂ emissions will be reduced by nearly 80%.

Consortium Members
 Verolube Inc.
 Parkland Fuel Corp.
 The Prasino Group
 Canada Ltd.

ZincNyx Energy Solutions*

Round 23 2013A

Environmental Benefits: Climate Change / Clean Air

Total Project Value:
\$9,025,684
 SDTC Funding:
\$2,900,000
 Leveraged Funding:
\$6,125,684

Rechargeable Zinc Air Fuel Cell
 The energy industry has not yet developed a battery that brings together the perfect combination of power capability, storage capacity and low cost. ZincNyx may have the solution with its Rechargeable Zinc Air Fuel Cell (RZFC) that uses zinc and air – two of the most abundant materials on Earth – as fuel. Used in a fuel cell, zinc provides high energy density, rapid kinetics, chemical stability, and reversibility. This type of fuel cell specifically separates the charge, discharge and storage functions, so that they can be independently tailored to the specific customer's needs. This project will scale up a technology from its original intended purpose – remote telecommunications site power back-up – to a wider market: microgrid energy storage, where these units can augment or displace diesel power generation. An intermediate scale demo unit (5 kW / 40 kWh) will be installed at UBC's Clean Energy Research Center for two years, where the performance of the RZFC technology will be evaluated under different conditions and load parameters.

Consortium Members
 ZincNyx Energy Solutions
 University of British Columbia
 Teck Resources Ltd.
 National Research Council
 Tri-State Generation and
 Transmission Association

Round 22 2012B Board Approval June 2013

ExtremeOcean Innovation Inc.

Round 22 2012B

Environmental Benefits: Clean Water / Clean Soil

Total Project Value:
\$1,907,043
 SDTC Funding:
\$550,000
 Leveraged Funding:
\$1,357,043

TranSPAR Craft Full Scale Prototype Demonstration

Far offshore, stronger and more consistent winds are preferred for wind power generation than conditions closer to land. However, these high winds create extreme conditions that can make it prohibitively costly to maintain offshore wind installations. ExtremeOcean's TranSPAR craft is an innovative vessel that can provide greatly improved access to offshore wind turbines in high wave conditions. The TranSPAR features an elevated cabin and deep keel, which improves stability while in transit and when docking with wind turbines. This project will demonstrate the commercial viability of the craft through full-scale prototype field trials. The ability to access wind turbines in rougher seas promises to increase wind turbine availability and output by up to 20%, dramatically reducing emissions by offsetting power production from GHG-emitting power generation.

Consortium Members

ExtremeOcean Innovation Inc.
 Memorial University
 Husky Energy
 The Carbon Trust

Hifi Engineering Inc.

Round 22 2012B

Environmental Benefits: Clean Water / Clean Soil

Total Project Value:
\$6,000,000
 SDTC Funding:
\$2,000,000
 Leveraged Funding:
\$4,000,000

Pipeline Monitoring Using High Fidelity Sensors

In Canada, nearly 71,000 kilometres of oil-and-gas pipeline move approximately 1 billion barrels of product per year. A key challenge facing pipeline operators is the ability to accurately and quickly identify low volume fluid leaks. Building off their success developing a periodic monitoring technology to identify leaking wellbores, Hifi Engineering is going to demonstrate a continuous monitoring system for oil pipelines that will quickly identify and characterize low level leaks in new and existing pipe. Using specially designed fiber optic cables installed within or beside pipelines, Hifi will monitor several kilometres of pipeline at a time on a continuous basis, focusing initial market roll out to areas located within environmentally sensitive or populated areas. The Hifi acoustic system monitors for acoustic signatures that represent pre-cursors to leaks (mechanical activity in proximity to the pipe) and for leaks, and transmits the signal with very high fidelity to the surface based monitoring system. With the support of Enbridge, Hifi will prove the technology can identify and characterize low rate leaks and alert operators in time to prevent uncontrolled releases to the environment.

Consortium Members

Hifi Engineering Inc.
 Enbridge Inc.

Luxmux Technology Corp.**Round 22 2012B****Environmental Benefits: Climate Change / Clean Air / Clean Water**

Total Project Value:

\$2,970,750

SDTC Funding:

\$980,350

Leveraged Funding:

\$1,990,400**Steam Quality Optimization In Thermally Enhanced Heavy Oil Recovery**

Most of the oil in Canada's oil sands is recoverable using specialized thermal techniques such as "Steam Assisted Gravity Drainage" (SAGD), which uses steam to soften the oil underground and separate it from the sand. Ensuring that steam generators are operating efficiently is crucial to success. The best indicators for efficiency are steam quality and flow rates. Luxmux and Agar will be the first companies to demonstrate and market a novel Silicon Nanophotonic Fourier Transform Near Infrared (FTNIR) Spectrometer on chip (Nano-Spec™ FTNIR Chip) technology. The Luxmux platform will be integrated with Agar's advanced and proven multiphase technologies to provide a process measurement solution for thermally enhanced heavy oil recovery. The complete process measurement solution, designed for wet steam environments, will be used for instantaneous and accurate online monitoring of steam quality and multiphase flow for thermally enhanced heavy oil recovery. It is projected that heavy oil producers could increase the quality of steam by up to four percent on OTSG (once-through steam generator) boilers while avoiding tube scaling which results in tube overheating and tube rupture. The solution will assist heavy oil producers to increase production, decrease operating costs, reduce GHG emissions and decrease water consumption.

Consortium Members

Luxmux Technology Corp.

Cenovus Energy

Agar Canada

Macrotek Inc.**Round 22 2012B****Environmental Benefits: Climate Change / Clean Air / Clean Water / Clean Soil**

Total Project Value:

\$5,863,291

SDTC Funding:

\$1,953,700

Leveraged Funding:

\$3,909,591**Novel MVI Acid Gas Scrubbing Technology Project**

To avoid injecting contaminants into the atmosphere, industries use chemical reactions to "scrub" exhaust before it is emitted from smokestacks. However, current scrubbing techniques use caustic and oxidizing reagents (materials used to produce a chemical reaction). Macrotek has developed a ground-breaking suite of technologies that scrub in a novel, cost-effective and efficient way. The technology is developed initially to eliminate hydrogen sulfide (H₂S), which is a major component of acid rain, from industrial gas streams. The technology uses a regenerative reagent, drastically reducing reagent consumption. It also converts H₂S into its elemental form of sulphur, eliminating the current need to treat sulphate byproduct in wastewater streams. When full life-cycle costs are considered, this technology could cost less than 50 percent of the operating costs of traditional scrubber technologies, while maintaining or improving contaminant removal efficiency. This technology has the potential to address a multitude of other pollutants, such as nitrogen oxides, simultaneously.

Consortium Members

Macrotek Inc.

Plasco Energy Group

Vive Crop Protection Inc.

Polymer Research Technologies**Round 22 2012B****Environmental Benefits: Climate Change / Clean Soil**

Total Project Value:

\$3,350,478

SDTC Funding:

\$1,116,826

Leveraged Funding:

\$2,233,652**Pilot Scale Production of Recyclopol™ Polyols
(Polyurethane Recycling)**

Not many know what polyurethane foam is, but chances are most of us have used it today. Based on a petroleum-based substance called polyol, nearly 5 million tonnes of polyurethane foam are produced in North America per year, and used in a wide range of products including construction materials, automobile parts, furniture, ridged insulation, packaging, textiles, footwear and adhesives. Every year, almost 3 million tonnes of waste polyurethane are incinerated or take up valuable limited landfill space, resulting in significant costs and impacts on the environment. Polymer Research Technologies has developed an innovative single stage proprietary technology that chemically converts waste polyurethane foam into high quality polyol which can be substituted for currently available polyols in products, thus cost effectively closing the loop on polyurethane recycling. The company has proven its technology at bench-scale, and is now working on the construction and operation of a pilot scale demonstration project.

Consortium Members

Polymer Research
Technologies
Johnson Controls
Woodbridge Group
Recticel

Soilless Technology Inc.**Round 22 2012B****Environmental Benefits: Climate Change / Clean Air / Clean Water / Clean Soil**

Total Project Value:

\$7,575,668

SDTC Funding:

\$2,500,000

Leveraged Funding:

\$5,075,668**Indoor Urban Farm**

Imagine a fresh strawberry, fully ripened and sweet – locally grown in Canada in February. It could happen, thanks to an integrated indoor food-growing system enabling sustainable, year-round, controlled-atmosphere agriculture at commercial scale while being located in urban centers. Soilless Technology has designed a system that uses water mist (aeroponics), low-energy lighting and high-density tray-and-trough configurations all adapted to fit in a standard urban industrial building. The process is specifically designed to optimize the growth of a variety of plants without sunlight while handling the needs of multiple crops on various crop cycles. These “Indoor Urban Farms” will cost less to build and operate than a greenhouse, and use less energy to operate. The system avoids the need to transport fruits and vegetables hundreds of kilometers, and related GHG emissions.

Consortium Members

Soilless Technology Inc.
Sunterra Quality Foods Inc.
Tava/Codema Systems Group
BM Potter Consultants

Solanro Semiconductor Corp.

Round 22 2012B

Environmental Benefits: Climate Change / Clean Air

Total Project Value:
\$11,600,500
 SDTC Funding:
\$3,800,000
 Leveraged Funding:
\$7,800,500

Self-Forming Dynamically Scalable Renewable Energy NanoGrids
 The International Energy Agency (IEA) predicts that global demand for electricity will grow by over 70% by 2035, requiring an investment of \$6.8 trillion to upgrade and extend the worldwide electricity distribution network. Renewable energy is stepping in, however it can be difficult and costly to integrate into the conventional grid, partly because of the need to deal with its varying level of power output. Solantro Semiconductor addresses this through control software running on custom-designed integrated circuits distributed throughout a local electrical grid. The software decides how to balance supply and demand, as well as when to draw on or refill the supplies of stored energy – all in real time and autonomously, eliminating the need for a centralized controller. This project could be a new model for consumer-level deployment of renewables, accelerating the displacement of fossil fuels both on- and off-grid.

Consortium Members
 Solantro Semiconductor Corp.
 Celestica International
 Outback Power Technologies
 Île infinie

Steeper Energy Canada Ltd.

Round 22 2012B

Environmental Benefits: Climate Change / Clean Water

Total Project Value:
\$10,453,000
 SDTC Funding:
\$3,000,000
 Leveraged Funding:
\$7,453,000

Hydrofaction™ CPS
 Of the 3.2 million barrels a day produced by Canada's oil industry, 1.7 million barrels are heavy oil. This thick, heavy oil does not flow easily within the pipelines designed to transport it, so operators thin it out using a diluent. A common diluent is natural gas condensates (NGC) which is becoming more difficult to procure, necessitating import from abroad. Steeper Energy Canada's Hydrofaction™ technology is a catalytic hydrothermal process that transforms biomass feedstock such as forestry or agricultural residues into synthetic bio-crude oil, which can then be used as a renewable diluent. This measure reduces the use of and costs associated with imported diluent while improving Canada's overall energy industry carbon footprint; furthermore the synthetic bio-crude oil can be refined to drop-in fuels such as diesel and jet fuel using existing North American refinery infrastructure.

Consortium Members
 Steeper Energy Canada Ltd.
 Alberta Innovates
 Technology Futures
 Fortistar Biomass LLC

Switchable Solutions Inc.**Round 22 2012B****Environmental Benefits: Climate Change / Clean Water / Clean Soil**

Total Project Value:
\$15,600,000
 SDTC Funding:
\$5,200,000
 Leveraged Funding:
\$10,400,000

SSI Field Pilot

Extracting bitumen from mined ore is an energy- and water-intensive process that relies on technology developed in the 1920's. Switchable Solutions has developed a solvent-based bitumen extraction process that is expected to economically process and recover bitumen from ore, using half the energy of the current process, and only 15 percent of the water. The switchable hydrophilicity solvent (SHS) process uses bubbled CO₂ to change the solubility properties of the solvent, to 'switch' the affinity of the solvent for hydrocarbons to an affinity for water, enabling its efficient recovery and re-use. This process operates on a cost-competitive basis with current methods and will increase the bitumen recovery efficiency to more than 95 percent for lower grades of ore, and more than 98 percent for the richer bitumen ore. In the Athabasca oilsands alone, low-quality ore makes up approximately 20 percent of total mineable reserves. This means that 26 billion barrels of low bitumen reserves could now be processed, representing \$1.5 trillion in untapped revenues without increasing a mine's footprint.

Consortium Members
 Switchable Solutions Inc.
 Total E&P
 CNRL

Ubiquity Solar Inc.**Round 22 2012B****Environmental Benefits: Climate Change / Clean Air**

Total Project Value:
\$9,992,106
 SDTC Funding:
\$3,122,445
 Leveraged Funding:
\$6,869,661

High Performance PV Polysilicon and Ingot Plant

The solar industry continues to look for reductions in the cost of modules and increases in performance and reliability in order to make solar power increasingly attractive. Ubiquity Solar Inc.'s SolarBrick™ is the product of a new approach to using monocrystalline silicon to convert sunlight into electricity. The modules made with this material are more efficient than current industry standard products, are less susceptible to light-induced degradation and hold the potential for very long lifetimes, resulting in a major increase in the energy captured over the lifespan of a solar system. This technology will further improve the economics of solar energy, increasing the profits of component manufacturers and expanding the environmental benefits of PV.

Consortium Members
 Ubiquity Solar Inc.
 University of Waterloo, Centre
 for Advanced PV Devices
 and Systems ("CAPDS")
 Fraunhofer Center for
 Silicon Photovoltaics CSP
 McMaster University
 ECN Solar Energy, Silicon
 Photovoltaics
 Jerry Olson Consulting
 Core Business Developers LLC
 University of Toronto
 Si Con
 DJ Met Consulting

Unit Electrical Engineering Ltd.

Round 22 2012B

Environmental Benefits: Climate Change

Total Project Value:

\$1,043,082

SDTC Funding:

\$344,217

Leveraged Funding:

\$698,865

Energy Efficient Transit Propulsion Pilot Program Project

Propulsion systems – or drivetrains – on mass transit rail vehicles represent up to 60 percent of their total energy consumption and also make up four percent of their total weight – factors that reduce the efficiency of the entire mass transit operation and drive up emissions. Unit Electrical Engineering and its consortium are building more powerful, lighter and more efficient propulsion systems. One function of the propulsion system in particular, the Linear Induction Motor or LIM, is being redesigned and optimized to reduce the weight and improve efficiency of the current air-cooled unit by 10 percent. The optimization of the LIM translates into lowered capital costs, reduced lifecycle costs, and contributes to a reduction in electricity costs to the end user. The optimized LIM will also address the differing needs for transit systems in emerging markets by introducing a more effective cooling approach that protects from sand and temperature extremes, making this product ideal for export opportunities, specifically in the Middle East where rail is an emerging sector with close to \$165B worth of projects.

Consortium Members

Unit Electrical Engineering Ltd.
Bombardier Transportation
Canada Inc.

Vive Crop Protection Inc.

Round 22 2012B

Environmental Benefits: Clean Water / Clean Soil

Total Project Value:

\$11,050,199

SDTC Funding:

\$3,723,504

Leveraged Funding:

\$7,326,695

Targeted Delivery for Crop Protection

The best crop protection happens when pesticides stay where they are intended to protect the crop, for example on a crop's leaves or at its roots. Vive has developed Allosperse®, a tiny particle that has unique properties: it has a hydrophilic (water-loving) exterior and an oleophilic (oil-loving) interior. Pesticides, which are also oleophilic, are loaded into the particle before application to crops. The next generation of Allosperse particles will have increased stickiness to leaves, avoiding run-off during the rain, and will penetrate leaves and seeds to offer systemic plant protection. Finally, the specially-designed particles will control the movement of the particle through the soil, allowing it to target pests at the plant's roots. Less product, and therefore less cost, would be required to achieve equivalent results, and growers can get better protection with less accidental surface water run-off and soil contamination.

Consortium Members

Vive Crop Protection Inc.
Halltech Inc.
Dow AgroSciences LLC
Adjuvants Unlimited
Loveland Products, Inc. (A
Division of Crop Production
Services)
University of Toronto Institute
for Optical Sciences
Makhteshim Agan of North
America, Inc.
University of Alberta Office of
Environmental NanoSafety
McGill University

Section 4: SD Tech Fund™ - 2013 Completed Projects

This section provides a summary of projects completed, or reporting on market impacts, in 2013.

For each completed project, the project results have been highlighted and an evaluation of the Project Impacts¹ has been included within this section. Post-project reporting continues past project completion so as to understand the evolution of the technologies and the Market Impact of each funded project. Such market impacts are reported two years after project completion and the relevant project updates are included in this report.

It is important to recognize that SDTC funding is focused on the development and demonstration of new technologies. In so doing, projects progress from early development along the innovation chain towards commercialization. This staged approach to innovation results in some successful projects requiring further development and/or demonstration before reaching commercialization. Understanding that the purpose of the fund is to assist with de-risking of technology, it is to be expected that a number of projects may not succeed either from a technological or economical perspective.

A full listing of all completed projects can be found in the Results section of our website.

¹ It should be noted that while the project activity may be completed in a particular year, SDTC can only report Project Impacts after the final reports have been submitted and reviewed. As such, for 2013, 10 projects completed close to year end and will be reported next year once the final reports are received.

Inventys Thermal Technologies Inc.

Round 16-2009B

Sector:
Energy Exploration and Production

Project Delivery Completion:
November 2013

Market Impact Report Due:
November 2015

Total Project Value:
\$3,914,947
(pending final audit)

SDTC Funding:
\$1,598,001

Leveraged Funding:
\$2,316,946

Consortium Members:
Inventys Thermal Technologies Inc.
Husky Oil Operations Ltd.
Mast Carbon

Environmental Benefits
(primary benefit bolded)
Climate Change

Project Title:

VeloxoTherm™ Gas Separation Demonstration Process

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 a third of the cost of the leading separation technology for post combustion capture of CO₂ from industrial flue gas streams.

Objectives:

- Scale-up of the VeloxoTherm™ process from the process demonstration to prototype scale.
- Integration of multiple sorbent structures in the prototype plant to implement the separation process which fully implements all the energy saving features of the VeloxoTherm™ process cycle.
- Fabrication of structured sorbent for use with the VeloxoTherm™ process.
- Demonstration of the durability of the structured sorbent to rapid heating and cooling cycles, to high velocity gas flow, and to contaminants present in actual flue gases.
- Completion of a conceptual design package for a first-of-a-kind VeloxoTherm™ plant.

Results:

- The VeloxoTherm™ process was scaled up from a process demonstration unit prototype stage (0.1 tpd) to a prototype plant (1 tpd) which was operated for more than 500 hours.
- Multiple variants of structured sorbent were evaluated in the process demonstration unity (PDU). Based on demonstration data and process modeling CO₂ separation can be achieved with a recovery of 90% and a CO₂ purity of 97 mol%.
- Adsorption and desorption cycles were defined for the prototype plant for use in continuous mode.
- There was no indication of any adsorbent bed performance degradation throughout the demonstration.
- The conceptual design package for the first-of-a-kind VeloxoTherm™ plant was completed.

Project Impacts:

- This project demonstrated the CO₂ separation capability of the VeloxoTherm™ process. Inventys' next step is to demonstrate the unit in the field with Husky Oil Operations Ltd.

Path to Market:

- Inventys will demonstrate the unit in the field with Husky for an application in heavy oil enhanced oil recovery (HOEOR).
- In addition to HOEOR, Inventys is targeting applications for light oil enhanced oil recovery (LOEOR) and CO₂ capture for climate change purposes (CCS)

Titanium Corp. Inc.

Round 14-2008B

Sector:

Energy Exploration and Production

Project Delivery Completion:
October 2013

Market Impact Report Due:
October 2015

Total Project Value:
\$21,526,442

SDTC Funding:
\$6,292,635

Leveraged Funding:
\$15,233,807

Consortium Members:

Titanium Corp. Inc.
Province of Alberta &
Department of Energy
Syn crude Canada Ltd.
Sojitz Corp
Canadian Natural
Resources Ltd.
Suncor Energy Inc.

Environmental Benefits (primary benefit bolded)

Clean Water

Clean Soil
Climate Change

Project Title:

Creating Value and Reducing Emissions by the Recovery of Valuable Products from Oil Sand Tailings

Project Description:

The Canadian oil sands mining industry is heavily reliant on water. Titanium Corp. has developed a process that adapts technologies from bitumen and mineral extraction and reduces the use of fresh water, increases water recycling and recovers valuable products from oil sand tailings. The process uses cyclone separation, solvent washing, flotation, boiling point differences and flocculation to separate valuable products, prepare water for recycling and prepare residual tailings for disposal. The process is expected to reduce the amount of fresh water used by oil sands mining operations by over 10% and reduce the volume of water going to tailings ponds.

Objectives:

- Construct a Creating Value from Waste (CVW) process pilot plant to demonstrate the continuous operation of the process.
- Reduce hydrocarbon levels on produced heavy minerals to less than 1% weight.
- Produce a zircon concentrate with approximately 30% zircon content.
- Achieve a bitumen recovery of greater than 50% and solvent recovery of greater than 80%.

Results:

- The CVW Process was successfully constructed and demonstrated at CanmetENERGY in Devon, Alberta.
- Hydrocarbon levels on produced heavy minerals were reduced to less than 0.5% weight.
- Premium grade zircon was produced in concentrates with 65%+ zircon dioxide content.
- Typical bitumen recovery values ranged from 80% to 90%. Solvent recovery exceeded expectations with 93% to 95% reporting to product.

Project Impacts:

- The demonstration of Titanium Corp.'s process was for testing purposes and not intended to produce saleable bitumen or minerals. When fully integrated into a commercial oil sands operation, Titanium's technology will deliver a net reduction of 5% GHG emissions and over a 70% reduction in VOC emissions.
- The CVW process is expected to result in soil benefits by reducing solids, heavy metals, and hydrocarbons sent to tailings ponds; however, these benefits have not been assessed quantitatively.
- The roll-out of the CVW process from 2014-2023 is expected to result in cumulative GHG emissions reductions of 8.9 Mt CO₂e from bitumen recovery and 1.2 Mt CO₂e from minerals recovery, for a total of 10.1 Mt CO₂e and CAC emissions reductions of approximately 28 kt NO_x and 495 kt VOCs.

Path to Market:

- Titanium Corp.'s mission is to develop and build a commercial process to recover heavy minerals (primarily zircon) and bitumen from oil sands tailings. The recovered materials will provide a source of additional revenue and environmental benefits for the oil sands industry.
- Titanium's CVW™ process is ready for commercialization and the Company is working with oil sands operators to determine the appropriate business arrangements to sanction a first project.

Automotive Fuel Cell Cooperation Corp.

Round 15-2009A

Sector:

Transportation

Project Delivery Completion:

October 2013

Market Impact Report Due:

October 2015

Total Project Value:

\$51,997,205

SDTC Funding:

\$11,558,274

Leveraged Funding:

\$40,438,931

Consortium Members:

Automotive Fuel Cell
Cooperation
Daimler AG Group
Ford Motor Company

Environmental Benefits

(primary benefit bolded)

Climate Change

Clean Air

Project Title:

Advanced Automotive Fuel Cell Development

Project Description:

The project, Advanced Automotive Fuel Cell Development, led by Automotive Fuel Cell Cooperation Corp. (AFCC), focused on development activities essential for commercialization of Daimler AG and Ford Motor Company fuel cell vehicles (FCV's). The technology consists of a proton exchange membrane fuel cell that utilizes catalyst to facilitate a low temperature electrochemical reaction of hydrogen and oxygen to produce electrical energy. The environmental benefits of implementing this technology in automotive applications is that it has no tailpipe greenhouse gas emissions and has the potential to be generated with lower carbon renewable resources, compared to baseline gasoline or diesel passenger vehicles. Additional benefits of FCV's are that they provide a no compromise solution, specifically fast refueling times and range comparable to an equivalent gasoline powered vehicle. The past generation of FCV's are highly functional and durable as demonstrated both by the Mercedes-Benz F-CELL World Drive and the hundreds of fuel cell cars currently in customer hands. AFCC designed and demonstrated a project that improved manufacturability, reduced quantities of expensive materials while increasing power density. These advancements were an essential step towards commercialization of the technology.

Objectives:

- To reduce the cost of fuel cell technology by 85%, increase the power density by a factor of two, and half the catalyst loading.
- To improve bipolar plates (thinner/lower cost) and increase performance of membrane and catalyst.
- To increase volumetric power density (smaller footprint) to allow for "under-hood" design.

Results:

- Overall product cost has been significantly reduced by 85%. This was achieved with a 2x increase in power density which results in half the amount of membrane, catalyst and gas diffusion materials for the same power as the past generation. In addition the catalyst loading (mg/cm²) was reduced by over 50%, resulting in 80% less catalyst needed.
- Development activities over the course of the project also focused on design for manufacturing. The final design was manufactured under early, pilot automotive series production processes at the Mercedes Benz Fuel Cell pilot plant in Burnaby, BC.
- Increases in power density also reduced the total volume of the stack by almost 50%. This allowed for a transition from "under- floor" to "under-hood" packaging reducing overall vehicle cost as common electric vehicle power-trains components can be used. AFCC successfully designed, built and tested several automotive fuel cell stack designs and have taken steps towards closing the gap to commercialization.

Project Impacts:

- Emission reductions associated with the project based on one vehicle, were estimated to be 2.9 t/yr CO₂e, 5.5 kg NO₂/yr, 3.02 kg SO₂/yr, 210.82 kg CO/yr, and 0.53 kg PM/yr.

Path to Market:

- While the FC stack designed in the project was successfully integrated into development vehicles, assessments by consortium partners conclude that additional progress towards high volume commercialization of FCV's is necessary before roll-out.
- AFCC and its consortium members are committed to further closing the gap to commercialization with investment in design and development activities on a project for the next generation of FC stack technology focused on design for high volume manufacturing and processes necessary to achieve targets for commercialization with anticipated vehicle deployment in the 2017/2018 timeframe.
- It is assumed that by 2024, approximately 57,000 FCVs will be rolled-out in Canada and 1.1 million in the rest of the world.

Woodland Biofuels Inc.

Round 17-2010A

Sector:

**Forestry, Wood Products
and Pulp & Paper**

Project Delivery Completion:
August 2013

Market Impact Report Due:
August 2015

Total Project Value:
\$12,900,000

SDTC Funding:
\$4,275,000

Leveraged Funding:
\$8,625,000

Consortium Members:

Woodland Biofuels Inc.
Bioindustrial Innovation Centre

Environmental Benefits

(primary benefit bolded)

Climate Change

Clean Water

Clean Soil

Project Title:

Biomass to Cellulosic Ethanol Demonstration Plant

Project Description:

Woodland Biofuels has developed a Catalyzed Pressure Reduction (CPR™) technology to convert waste biomass feedstocks into cellulosic ethanol. The CPR™ process involves five key steps including steam gasification of dry (5-15% (wt/wt) moisture) biomass (to produce syngas), syngas cleanup and conditioning, conversion of syngas to methanol, carbonylation of methanol (to produce methyl acetate), and hydrogenation of methyl acetate (to produce fuel grade ethanol). The greenhouse gas (GHG) emission reduction benefits of the technology, compared to fermentation based ethanol production, are realized through the use of the syngas in place of natural gas for process heating.

Objectives:

- Design, build and test a demonstration-scale plant capable of producing ethanol at a rate of 28 L/hr.
- Validate design parameters.
- Demonstrate the efficient, low cost conversion of biomass to cellulosic ethanol using an innovative catalytic process expected to produce 600,000 L/yr of ethanol.
- Integrate process controls for efficient plant control and operation.
- Evaluate plant operating parameters and test innovations and modifications to the process.
- Validate the value proposition and market requirements of operating a biomass-to-ethanol facility using locally supplied feedstock materials.

Results:

- Woodland designed, installed and commissioned their pilot scale demonstration plant.
- Woodland has successfully converted biomass to ethanol at a rate of approximately 5 L/hr and is making incremental progress as it continues to develop the technology beyond the SDTC project timeline to meet its target objective of 28 L/hr.
- The gasifier, the methanol reactor, the methyl acetate reactor and the ethanol reactor were commissioned as an integrated process.
- Evaluation of plant operation and plant parameters is ongoing as Woodland was not able to complete the full commissioning test plan. As of October 2013, the plant run time was approximately 25 hours of continuous operation and 100 hours of cumulative operation.
- Woodland has researched the market requirements of operating a biomass-to-ethanol facility in southern Ontario, where it expects to build its first commercial 80 ML/yr plant.

Project Impacts:

- GHG and air emission reductions (for the roll out) result from the use of syngas (generated during the gasification stage) in place of natural gas for process heating.
- GHG emissions reductions associated with the initial and subsequent plants were estimated to be 0.41 kg CO₂e/L ethanol.
- Total emissions reductions associated with the pilot plant (operating from 2013 to 2015) were estimated to be 7,806 t CO₂e, 16.2 t NO₂, 105.4 t SO₂, 4.9 t CO, 0.44 t PM, and 0.32 t VOC.

Path to Market:

- The Woodland pilot plant will continue to refine operating processes throughout 2014 - 2015, and once continuous operation has been demonstrated, ethanol plants based on the CPR™ process will be rolled out in two phases: one initial facility, to be constructed in 2016 will produce ~80 ML ethanol/yr and the first subsequent facility, to be constructed in 2018, will produce ~190 ML ethanol/yr.

AUG Signals Ltd.

Round 13-2008A

Sector:

Energy Utilization

Project Completion Date

August 2013

Market Impact Report Due:

August 2015

Total Project Value:

\$5,893,654

SDTC Funding:

\$2,020,661

Leveraged Funding:

\$3,872,993

Consortium Members

AUG Signals

EPCOR Water Services

National Water Research
Institute

University of Toronto

FuseForward International Inc.

University of Calgary

Communications Research
Centre Canada

Environmental Benefits

(primary benefit bolded)

Clean Water

Climate Change

Clean Air

Project Title:

Airborne Underwater Geophysical (AUG) Signals' Intelligent Drinking Water Monitoring System (IDWMS)

Project Description:

AUG has developed an Intelligent Drinking Water Monitoring System (IDWMS) and has tested and demonstrated the technology at EPCOR's Edmonton Waterworks Rosssdale Treatment Facility and South Service Center throughout the time period of 2009-2013. The IDWMS monitors municipal drinking watery quality and provides an additional layer of protection to support water treatment systems' efforts to keep drinking water safe. The IDWMS is a multi-sensor fusion engine that combines different information domains through multiple off-the-shelf sensor array sites and innovative online spectrophotometer sensor. IDWMS units are located strategically throughout municipal water distribution system(s) providing syndromic surveillance, waterborne event detection and identification, and contaminant concentration estimation. The system also has the capacity to detect pipe leaks along the distribution system. Electricity is the only form of energy consumed by the IDWMS during unit operation. The IDWMS reduces greenhouse (GHG) emissions, water leakage, waterborne contaminants (nitrite, nitrate, copper, iron, and acrylamide), and some criteria air contaminants.

Objectives:

- Demonstrate and validate the single IDWMS unit's performance (such as detection accuracy and false alarm rate) at two testing sites at the City of Edmonton's water distribution network.
- Further enhance system's monitoring capability (more contaminants) to meet specific user requirements.
- Integrate the IDWMS into Edmonton's existing water monitoring infrastructure; and complete other necessary pre-commercialization activities to ensure successful market launch.

Results:

- The project demonstrated the use of two IDWMS units at EPCOR's Edmonton Waterworks Rosssdale Treatment Facility and South Service Center and validated the technology's high detection accuracy of 96.5% with a negligible low false alarm rate throughout 3 years of site testing.
- In cooperation with EPCOR, AUG Signals validated the use of IDWMS units integrated with EPCOR's Edmonton Waterworks System, which have the ability to monitor contaminants that were of key interest to target municipal customers (i.e., London, ON, and Tianjin, China, Keewaytinook Okimakanak (Deer Lake) and First Nation, ON). This included responses to contaminants as well as contamination source tracing and flow prediction and the interaction of sensor and non-sensor data.

Project Impacts:

- On average 20% of all municipal drinking water is lost due to pipe leaks. The amount of water to be saved will result in reduced electricity energy consumption. GHGs are produced by electricity generation using fossil fuel combustion. The project impacts per IDWMS unit installed per year is 23.9 t of CO₂e along with a 70% reduction in water leakage (21.9 ML). Over the 12 year project duration, the AUG Signals' technology is expected to result in a reduction of 54,762 t CO₂e and 505,114 ML reduction in water leakage.

Path to Market:

- The three main target customers for the technology are municipal utilities, public corporations, and public private partnerships (P3s, usually companies contracted to design, build, operate or manage components of a public water supply system) in North America and China. Following certification for use as a screening tool by regulatory agencies in Canada, the USA, and China, the IDWMS technology will be marketed under the product name "Triton Intelligent Water Surveillance". Market entry is scheduled for Q1 2014.

SunCentral Inc.**Round 13-2008A**

Sector:

Energy Utilization

Project Delivery Completion:

June 2013

Market Impact Report Due:

June 2015

Total Project Value:

\$7,035,838

SDTC Funding:

\$2,345,208

Leveraged Funding:

\$4,690,630**Consortium Members:**

SunCentral Inc.

University of British Columbia

British Columbia Institute of
Technology

BC Hydro

Natural Resources Canada

3M Canada Company

Ledalite Architectural Products

Busby Perkins and Will,

Architects

Morrison Hershfield

York Communications

Environmental Benefits

(primary benefit bolded)

Climate Change

Clean Air

Project Title:

Solar Canopy Illumination System Demonstration Project

Project Description:

The Core Sunlight System, now called “SunCentral System,” consists of external sunlight collectors (solar canopies) and internal light guides integrated with standard dimmable light fixtures. When sunlight is available, the electrical lighting is dimmed, conserving energy. During this project, the feasibility and cost-effectiveness of the system were explored through seven demonstration installations.

Objectives:

- Enable a viable industry for cost effective core daylighting within the project timeframe by demonstrating the potential for reasonable payback time on direct energy savings.
- Reduce GHG emissions and energy use in office buildings by implementing core daylighting systems, saving a minimum of 3 hours of electric light use per day, 250 days per year (about 20%).
- Develop capabilities to manufacture canopies in low volume, using processes that could readily scale to larger volumes, with an ultimate cost as low as \$1,000 per panel module.
- Refine the manufacturing and assembly processes to optimize the design for volume fabrication, and advance the integration of sunlight, control and luminaire design in order to reduce the electrical energy required to illuminate buildings by more than 36%.

Results:

- By implementing the SunCentral System and taking into account the cost savings of replacing electrical lighting with sunlighting and the HVAC savings associated with sunlighting, the payback period is 8-10 years.
- Measured savings at one SunCentral System indicated a conservative electrical lighting savings value of 24%, which leads to a corresponding reduction in GHG emissions from electrical generation. Lighting accounts for a significant amount of the electricity use in office buildings, hence the overall building emission savings will be significant.
- SunCentral believes with higher volume manufacturing and a lower cost supply chain they can achieve 1,000 per module in several years.

Project Impacts:

- At the BCIT site, the SunCentral System demonstrated an average daily savings of 36%. Subsequent installation sites deployed SunLuminaires with LEDs as the electric light source. The integration of LEDs allowed the electric light system to be fully switched off during sunny periods resulting in energy savings of more than 37%.
- Annual per module GHG emission reductions of 7 kg CO₂e for Canada and 57 kg CO₂e for the rest of the world are expected.

Path to Market:

- SunCentral will employ a highly leveraged channel partner sales model. They are offering their products to major building curtain wall manufacturers for integration with Unitized Curtain Wall Systems (the “skin” for high-rise towers). SunCentral will also partner with well-established lighting companies to market and integrate their product lines as a value added subsystem. SunCentral has secured contracts for sales channel partnerships with nine US territories and the Philippines and are in discussions for 14 more US territories and Canada.
- Market roll-out is anticipated to begin in 2014. The cumulative GHG savings, by 2030, is expected to be 4.8 kt CO₂e in Canada and 377 kt CO₂e in the rest of the world.

General Electric Canada

Round 11-2007A

Sector:

Transportation

Project Delivery Completion:

June 2013

Market Impact Report Due:

June 2015

Total Project Value:

\$11,721,903

SDTC Funding:

\$3,903,394

Leveraged Funding:

\$7,818,509

Consortium Members:

GE Canada

Canadian National Railway
Company Corp.

Environmental Benefits

(primary benefit bolded)

Clean Air

Climate Change

Project Title:

Clean Diesel Locomotive Program

Project Description:

GE Canada and its consortium member have developed and tested an exhaust aftertreatment system (ATS) for their Evolution locomotive developed in 2005. This project involved the development and implementation of 2 ATS prototypes that would improve air quality by significantly reducing criteria air contaminants (CAC) to surpass current regulations set by the U.S. Environmental Protection Agency (EPA) Tier 3 emission standards.

ATS 1 technology consisted of a urea-SCR catalyst to reduce levels of oxides of nitrogen (NO_x), a Diesel Oxidation Catalyst (DOC), and a diesel particulate Flow Through Filter (FTF), and an Ammonia Slip Catalyst (ASC) integrated into the locomotive to reduce various CACs. In particular, the integrated ATS system would significantly reduce the levels of NO_x, particulate matter (PM), hydrocarbons (HC) and carbon monoxide (CO), all of which the railway industry significantly contribute at present.

The second system, ATS 2 was developed without the Selective Catalytic Reduction (SCR) system for use on locomotives which achieve Tier 4 NO_x levels in the engine. The ATS 2 reduces particulate matter. A manual hydrocarbon (diesel fuel) injection system is also part of the ATS 2 system.

Objectives:

- Design of the ATS 1 to meet functional and design specifications. This included small scale testing of catalyst and substrate samples on a slipstream rig in Erie, PA. Data from this testing was used for ATS test prototypes.
- Field testing of the ATS 1 prototype on a GE Evolution Series Tier 2 locomotive provided by CN Rail, followed by a tear down and analysis of the unit.
- Development of ATS 2 based on the analysis and results from field tests to meet the PM reduction goals. Conduct a three month locomotive field test of the ATS 2 on the same CN Tier 2 locomotive, with stationary testing before and after the field testing to measure engine performance and emission data.
- Meet environmental standards by achieving 65% reduction in NO_x compared to the current "Tier 2" limits with the ATS 1; and an 85% reduction in PM, HC and CO compared to the current "Tier 2" limits with the ATS 1 and ATS 2 systems.

Results:

- Successful completion of ATS 1 design using a urea-SCR system.
- Field testing of the ATS 1 demonstrated functional and design suitability when integrated with GE Evolution Series Tier 2 locomotive
- Based on the ATS 1 results and advancements in technology, ATS 2 consisted of a Diesel Oxidation Catalyst (DOC) and Flow through Filter (FTF) system design to be used as a retrofit kit for both "Tier 2" and "Tier 3" engines
- The project resulted in CAC emission reductions primarily from the application of the ATS design on a GE Evolution diesel locomotive. There was approximately an 85% reduction in PM₁₀, HC and CO compared to the same locomotive without the ATS 2 system. NO_x emissions were not reduced with the ATS 2 systems.

Project Impacts:

- GE Canada will provide a competitive retrofit solution for PM reductions to complement their line of locomotives thereby reaching regulated North American emission standards.
- The results of the project have validated the environmental benefits of the ATS technology integrated with a GE Evolution diesel locomotives.

Path to Market:

- Due to a prevailing technology development shift to the use of natural gas (NG) as locomotive fuel, the diesel locomotive ATS will be redeveloped to become an integral part of the new NG locomotive system. By switching to NG the rail industry will be able to reduce its fuel cost and lower the emissions in key categories. The NG locomotive technology is still in the developmental phase and the ATS will continue to be a necessary part of the new technology.
- NG is a clean fuel. ATS, as part of the NG locomotive system, will provide an attractive means for meeting regulatory emission standards, including retrofit kits for existing engines. GE is currently developing the NG locomotive technology with the ATS application. Adopting this technology by the rail industry will heavily depend on the logistics solutions for the supply of liquefied natural gas (LNG) as a fuel, the infrastructure of refueling LNG, and safe deployment of LNG fleet.

Great Northern Power Corp.

Round 5-2004A

Sector:
Power Generation

Project Delivery Completion:
June 2013

Market Impact Report Due:
June 2015

Total Project Value:
\$7,265,541

SDTC Funding:
\$2,063,403

Leveraged Funding:
\$5,202,138

Consortium Members:
Great Northern Power Corp.
AltaGas Operating Partnership
Canadian Environmental
Technology Advancement
Corp. - West
(CETAC - West)

Environmental Benefits:
(primary benefit bolded)
Climate Change
Clean Air

Project Title:

Power Generation Utilizing Great Northern Power's Organic Rankine Cycle Technology for Recovering Waste Heat from Reciprocating Engines at AltaGas Compressor Stations in Alberta, Canada

Project Description:

Great Northern Power (GNP) developed their proprietary GNP-115 waste heat recovery system, which uses an Organic Rankine Cycle (ORC) operating on iso-butane to generate power from waste heat. It has been conceived as a "plug-and-play" pre-engineered and packaged system to match the thermal reject heat from large reciprocating engines (1000 HP and larger). The system should, on average, produce 115 kW of power from the waste heat rejected by a 1200 HP engine. The objective of this project was to reliably recover waste heat from a variety of 1000 HP and larger engines in order to generate electricity that could offset on-site electricity generation or be sent to the grid, thereby reducing GHG and CAC emissions.

Objectives:

- Detailed engineering, fabrication, installation, commissioning and testing of the GNP-115 on one of Altagas' 1200 HP reciprocating engines.
- Demonstrate that the GNP-115 is able to meet the technical objectives including a temperature adjusted power output of 115 kW and an on-stream operational uptime of 90%.
- Test the GNP-115 units on reciprocating engines of varying specifications and manufacturers representative of the range of 1000+HP engines in AltaGas' fleet.
- Evaluate the long-term performance of the GNP-115 system, confirming efficiency, up-time, maintenance requirements and costs.

Results:

- The GNP-115 system was successfully built, installed and tested on a compressor at Enerflex. The performance of the system, validated by an independent third party, demonstrated that it could produce 108 kW at design operating conditions.
- Delays in the project meant that long-term performance testing of the GNP-115 system was not completed. Post the SDTC project, the goal is to complete commissioning at AltaGas. Upon commissioning, nine more units will be built and tested under different conditions.

Project Impacts:

- If the GNP-115 system is installed on a 1200 HP reciprocating engine in Alberta, with electricity generated used to power engine cooling fans and offset grid electricity, this would result in GHG emissions reductions of approximately 680 t CO₂e/system/year.
- CAC emission reductions per system per year would be approximately 1 t NO_x and SO_x, 0.4 t CO, with smaller reductions of TPM, VOCs, and Hg.

Path to Market:

- GNP is in the process of demonstrating their GNP-115 on one reciprocating engine owned by AltaGas.
- GNP is currently negotiating sales of its technology and associated power produced with oil and gas companies in Canada.

Développement Effenco Inc.

Round 11-2007A

Sector:

Transportation

Project Delivery Completion:

March 2013

Market Impact Report Due:

March 2015

Total Project Value:

\$3,801,799

SDTC Funding:

\$1,074,955

Leveraged Funding:

\$2,726,844

Consortium Members:

Développement Effenco

Gadreau Environnement

Waste Management Québec

Agence de l'efficacité
énergétique du Québec

Veolia Environmental Service

North America

Environmental Benefits:

(primary benefit bolded)

Climate Change

Clean Air

Project Title:

Hybrid Refuse Truck

Project Description:

Développement Effenco Inc. (Effenco) and its partners completed the development and demonstration of a hybrid hydraulic regenerative braking system for refuse trucks, the Torque-Assist Hybrid System. Using a hydraulic pump, the system regenerates kinetic energy while the truck is braking. This energy is stored in a hydraulic accumulator to be reused later in the hydraulic operations of the vehicle. The system is expected to be more cost effective than hybrid electric solutions. The project's main objective was to reduce refuse truck fuel consumption by 15% as compared to the incumbent system. These savings were to be demonstrated by collecting fuel use data from different refuse trucks operating on waste collection routes.

Objectives:

- Design, manufacture, and test the hybrid refuse truck system with a goal of 15% reduction in fuel consumption.
- Demonstrate that the technology is practical, viable, and reliable in normal operating conditions. Reach 90% hybrid system availability and 95% truck availability (downtime of 5% or less due to maintenance issues).
- Prepare for the commercialization of the technology by building confidence among fleet operators in the hybrid system's performance and reliability.

Results:

- Effenco's Torque-Assist Hybrid System was successfully designed, manufactured, and installed on ten different refuse trucks during the demonstration period to monitor fuel savings. The average fuel savings for trucks equipped with Effenco's Torque-Assist technology was 7.7%.
- The truck availability target was easily met with a value of 98%; however, the hybrid system itself did not meet the target availability of 90%. Average system availability during the demonstration trials was 78%.
- Effenco's fleet operator partners were satisfied with the technology and continued to support the hybrid system technology throughout the demonstration project.

Project Impacts:

- The demonstration of Effenco's technology resulted in GHG emission reductions of 56 t CO₂e over the demonstration period, 2010-2012. The demonstration also resulted in small CAC emission reductions.
- Use of Effenco's technology can be expected to result in GHG emissions reductions of approximately 7 t CO₂e/yr in a diesel refuse truck and 5 t CO₂e in a compressed natural gas refuse truck.
- If Effenco's technology is rolled-out, it could be expected to result in cumulative GHG emission reductions of approximately 120 kt CO₂e in Canada and 240 kt CO₂e in the rest of the world from 2014-2026.
- A roll-out could also be expected to result in reductions of CAC emissions in Canada of approximately 90 t SO_x, 280 t NO_x, 60 t PM, 160 t CO, and 40 t VOCs. CAC reductions in the rest of the world would be approximately double these values.

Path to Market:

- While Effenco was pleased with the results of this demonstration project. Based on the innovation developed during the project, Effenco has turned its attention to commercializing the Engine-Off technology aspect, which is under the scope of a recent SDTC funded project (2011B-2090). Effenco is planning to commercialize this new technology.

EcoSynthetix Adhesives Inc.

Round 13-2008A

Sector:

Forestry, Wood Products and Pulp & Paper Products

Project Completion Date

March 2013

Market Impact Report Due:

March 2015

Total Project Value:

\$5,088,882

SDTC Funding:

\$1,679,331

Leveraged Funding:

\$3,409,551

Consortium Members:

EcoSynthetix Adhesives Inc.
Cascades Canada Inc.

Environmental Benefits

(primary benefit bolded)

Climate Change

Clean Air

Project Title:

EcoSphere® Biolatex Production and Application

Project Description:

EcoSynthetix Adhesives Inc. has developed a new bio-based latex product, EcoSphere Biolatex™, to be used in paper and paperboard manufacturing. This plant based substitute for traditional fossil fuel based latex achieves higher solids content and greater stiffness, reducing the energy requirements at the mill and reducing greenhouse gas emissions throughout the process. This project produced a bio-based latex product and demonstrated the commercial viability of EcoSphere® biolatex for paperboard production. EcoSphere® biolatex uses natural plant starch from corn, potatoes and rice to create a product that does not exhibit the usual flaws as traditional starch latexes such as shrinkage. Through a unique process, Ecosynthetix removes all of the native granular structure of the plant based starch and reduces average particle size which can be formed into an agglomerate of dry crosslinked biopolymer nanoparticles. The EcoSphere® biolatex has comparable properties and performance as synthetic latex used as binder in paperboard manufacturing, such as styrene butadiene latex (SB-latex) making it a viable substitute.

Objectives:

- The production of a new grade of biolatex suitable for paperboard application at the new biolatex pilot plant. A mill trial including processing of 25,000 pounds of raw materials and transforming them into EcoSphere® biolatex.
- Testing at Cascades and a final evaluation on quality to ensure it meets commercial grade standards.

Results:

- A biolatex technology pilot plant was established in Burlington, Ontario where 25,000 pounds of raw materials were processed into EcoSphere® Biolatex Paperboard Grade (EcoSphere® 92227). Quality assurance was tested. 5,000 pounds of raw materials were used in each of the two pilot scale trials which were conducted at Centre International de Couchage, Inc (CIC) to test the product on pilot coater and at Cascades to test paperboard quality.
- Pilot trial optimized the formulation based on the results from the first two trials and the paperboard was tested at Cascades. Final evaluation on quality was completed and validated that EcoSphere® met commercial grade standards.

Project Impacts :

- The project resulted in GHG emission reductions (estimated 4.57 t CO₂e /t of EcoSphere®). Following the completion of the project, the objectives are to roll out the use of the application over 12 years, resulting in the following reduction of GHG in the period 2012-2024: 572 kt CO₂e in Canada and 2.49 Mt CO₂e in the rest of the world.

Path to Market:

- Potential future application for EcoSphere® biolatex includes paints and coatings, adhesives, carpets and other markets. To date, the Company has commercialized the technology with greater than 30 mills, including the largest paper producer in North America and large producers in Japan, Canada and Germany. Based on these initial early adopter customers, the Company has produced and sold in excess of 100 million lbs since commercialization and has sales of 30+ million pounds per annum in 2013 or in excess of \$20 million dollars.
- Additional mill trials are also in progress with some of the largest producers globally and the Company has trials underway with 9 of the top 20 coated paper and paperboard producers globally.

MSR Innovations Inc.

Round 11-2007A

Sector:

Power Generation

Project Delivery Completion:

March 2013

Market Impact Report Due:

March 2015

Total Project Value:

\$1,473,397

SDTC Funding:

\$680,839

Leveraged Funding:

\$792,558

Consortium Members:

MSR Innovations Inc.

Century Group Lands Corp.

Environmental Benefits

(primary benefit bolded)

Climate Change

Clean Air

Project Title:

SolTrak™ Demonstration

Project Description:

Improving systems installation of building integrated photovoltaic (BIPV) is a key priority for the solar industry. MSR Innovations and its consortium members have developed and demonstrated a unique solar roofing system, SolTrak™, which dramatically improves the installation of solar PV systems. SolTrak's extensive design and manufacturing flexibility produces a sustainable product that will reduce the costs of solar power systems, enabling mainstream market entry. The production of renewable electricity by the SolTrak™ system is expected to result in a reduction of greenhouse gas (GHG) emissions in comparison with traditional power generation.

Objectives:

- Develop a modular building-integrated photovoltaic (BIPV) roof tile system consisting of polymer roofing tiles containing seamlessly integrated photovoltaic (PV) panels for electricity generation that can be mounted with an easy to install track system.
- Manufacture, install, and test a 120 W standalone SolTrak™ system providing lighting to a carport.
- Construct and operate a pilot scale assembly plant in Richmond, BC to provide data and analysis on manufacturing processes and to produce a 2.5 kW SolTrak™ system.
- Demonstrate a large scale SolTrak™ system (20 kW) in Langley, BC at the Congregate Home Centre developed by Century Group.

Results:

- The BIPV roof tile system, including active generating tiles and non-active spacer tiles, was successfully developed and tested at three different installations.
- A 120 W standalone SolTrak™ system was installed and tested, meeting technical requirements.
- A pilot scale assembly plant was constructed and operated on a carport, producing a 2.5 kW SolTrak™ system.
 - The system produced 8,500 kWh of electricity over the period from March 2009 to March 2013, with a normalized recorded peak of 2.48 kW.
- A 20 kW SolTrak™ system was installed on a Licensed Care and Seniors Congregate residence in Langley, BC.
 - The system produced 3,900 kWh of electricity over the period from January to March 2013, with a normalized recorded peak of 19.4 kW. The Levelized Cost of Energy (LCOE) for the solar tiles, including roof costs is ~\$0.21/kWh over the expected life of the roof (25 years) based on Vancouver, B.C.'s weather profile.

Project Impacts:

- The 2.5 kW and 20 kW demonstrations resulted in GHG emission reductions of 256 kg CO₂e and 41 kg CO₂e, respectively.
- The 2.5 kW installation generated sufficient electricity to assist in off-setting a significant portion of the daily electrical load of the neighbouring home (and, at times, to the surrounding homes within the neighbourhood), while the 20 kW installation provided enough electricity to cover the entire building's lighting despite being installed on only a wing (approx. 10% of the building) of the seniors structure.

Path to Market:

- MSR will initially focus on selling SolTrak™ systems to new homes being built in subdivisions by leveraging its relationships with homebuilders. The initial markets targeted will be in Ontario and California.

Pathogen Detection Systems

Round 12-2007B

Sector:

Waste Management

Project Delivery Completion:

December 2012*

Market Impact Report Due:

December 2014

Total Project Value:

\$8,599,000

SDTC Funding:

\$2,671,627

Leveraged Funding:

\$5,927,373

Consortium Members:

Pathogen Detection

Systems, Inc.

Hydromantis Inc.

Queen's University

University of Toronto

Environmental Benefits

(primary benefit bolded)

Clean Water

*Project related activities were completed in December 2012, however, final project reporting was completed in 2013.

Project Title:

Water System Monitor and Control

Project Description:

Pathogen Detection Systems (PDS), now known as Endetec with Veolia Water Systems (VWS) as the parent company, developed a technology that allows for on-site microbiological testing of source water samples at water treatment plants for E.coli (EC) and Total Coliforms (TC). The PDS technology uses a self-contained consumable test cartridge (CTC) to collect water samples. The CTCs are then inserted into a Desktop Testing Unit (DTU) and incubated to promote growth of target organisms. Embedded within the CTCs are chemical reagents with a patented polymer-optical sensor that enable the visual assessment of collected water samples for target organisms. The greenhouse gas (GHG) emission reduction benefits of the technology are realized mostly through eliminating the need for transport of water samples to off-site microbiological labs.

Objectives:

- Develop two DTUs (one 4-chamber unit and one 16-chamber unit) for automated testing of water and wastewater samples, and determine the viability of a 100 (or more) chamber DTU for high throughput volumes.
- Develop additional microbiological tests in Presence/Absence (P/A) and quantitative modes. The current combined EC/TC test is the standard for finished drinking water and has been validated for P/A use.
- Develop a water quality expert system that utilizes source water microbiological data (along with other water quality inputs) to determine and optimize treatment methods.
- Integrate the data generated by the DTU and water quality expert system to demonstrate the integrated systems performance at a number of municipal trials (6 separate trials at 4 municipalities).
- Develop a rational, science-based approach of setting disinfection goals based on the microbial quality of source water (i.e. Quantitative Microbial Risk Assessment (QMRA)).
- Develop detailed costing standards for each DTU (4 and 16 chamber) and determine the target market price.

Results:

- Both 4 chamber and 16 chamber units were developed as a result of market research to fit a market need for rapid water sample analysis. A rapid EC test was completed, providing test results in 2-18 hours depending on level of contamination compared to the current standard of 24-48 hours.
- The PDS technology that is being used to collect data at a site in Peterborough, ON with subsequent off-site data input and analysis with the Hydromantis software, is on-going.
- The PDS technology integrated with Hydromantis software was demonstrated at a site in Hamilton, ON for a short-term test; multiple trials were conducted in lieu of the planned municipal trials.
- QMRA report developed by the University of Toronto.
- Costing and pricing were developed by Endetec's Marketing team to be competitive.

Project Impacts:

- GHG and air emission reductions result from eliminating the need for transport of water samples to off-site microbiological labs.
- The demonstration trials were not carried out as planned, but the estimated emission reduction intensity based on assumed data was 2.56E-09 t CO₂e/m³ water treated.
- CAC emission reduction intensities were determined as follows: 2.81E⁻⁰⁹ t NO_x/m³, 6.84E⁻¹⁰ t SO₂/m³, 1.82E⁻¹⁰ t PM/m³, and 3.2E⁻⁰⁹ t CO/m³.

Path to Market:

The PDS technology will be rolled out through PDS's parent company's sales distribution network (VWS) from 2014 to 2025 with the assumptions of 183 installations in Canada and 351 installations in the rest of the world.

Integran Technologies Inc.

Round 12-2007B

Sector:

Transportation

Project Delivery Completion:

December 2012*

Market Impact Report Due:

December 2014

Total Project Value:

\$17,197,659

SDTC Funding:

\$5,616,635

Leveraged Funding:

\$11,581,024

Consortium Members:

Integran Technologies Inc.

Schaeffler Technologies

DuPont Canada

Environmental Benefits:

(primary benefits bolded)

Climate Change

Clean Air

*Project related activities were completed in December 2012, however, final project reporting was received in 2013.

Project Title:

Reduced Emissions through Lightweight Nanometal/Polymer (NP) Hybrid Enabled Automotive Components

Project Description:

Integran Technologies Inc., in collaboration with strategic development and commercialization partner Schaeffler Group of Germany, developed a parts manufacturing method using nanotechnology to produce automotive and other industrial parts, under the trademark Nanovate™. This involved coating light-weight polymers with high strength nanometal claddings (predominantly Ni, NiFe and Co) to produce high-strength and light-weight parts capable of replacing parts typically made of steel or aluminum. As a result of the reduction in weight, use of Nanovate™ parts in automotive applications would be expected to improve vehicle fuel economy, thereby reducing greenhouse gas (GHG) emissions associated with fuel combustion in vehicles.

Objectives:

- Complete the development of the power supply optimized for the nanometal electrodeposition process.
- Validate and demonstrate the viability and performance of Nanovate™ NP for automotive applications and have at least three diverse applications ready for commercialization.
- Demonstrate low to medium volume production of Nanovate™ NP parts through launching several fast to market applications.
- Create a portfolio of active quality lead application targets where Nanovate™ may be a viable option, thus increasing the overall potential with high visibility projects and applications.
- Demonstrate process capabilities and tools to support the production of Nanovate™ parts including:
 - A low/medium volume production process (pre-commercial pilot plating line).
 - Selective cladding capability which allows for the highest potential in weight savings.

Results:

- Integran successfully developed 100 kW and 200 kW power supplies capable of producing direct current and low frequency pulse (LFP) and pulse reserve current that is suitable for nanostructured metal plating processes.
- Although automotive proved to be a challenging market to access, Integran validated, demonstrated and prepared for commercialization the use of Nanovate™ NP for roller bearing cages which can be used in automotive applications. Aircraft engine components, aircraft interior fittings and consumer electronic components are also ready for market.
- Several aircraft components, and consumer electronic components were produced in low to medium volumes for production testing.
- Integran produced Nanovate™ aircraft engine components, roller bearing cages, aircraft interior parts such as table tray arms, frames for cell phones and tablets, and medical devices.
- Production capacity was established for both high quality low volume production of components as well as high volume production.

Project Impacts:

- GHG emissions associated with the demonstration project were negligible, as only a small mass of Nanovate™ NP was produced.
- The roll-out of Integran's Nanovate™ automotive parts is expected to result in cumulative GHG emission reductions of 465 kt CO₂e in Canada and 387 kt CO₂e in the rest of the world from 2013-2027.
- As a result of higher energy use in the manufacturing process, the roll-out of non-automotive parts is expected to result in an increase in GHG emissions of 8.9 kt CO₂e in Canada and 22.5 kt CO₂e in the rest of the world from 2013-2027.

Path to Market:

- In the near-term, Integran is primarily focused on aerospace and biomedical fields where new materials and innovations are highly valued and investments are made to qualify new processes.
- The aerospace field is being approached through an OEM with the production of engine parts and aircraft interior. This relationship is providing a good entry into related companies.
- Entry to the biomedical field is being addressed through testing for a number of different applications.
- The largest potential market for Nanovate NP is in consumer electronics for mobile phone or tablet internal frames. Commercialization will hinge on market uptake for the end product.
- The Integran facility in Toronto has AS9100 certification and can address relatively low volume, high quality production capacity manufacturing. Facilities in Mexico and China are capable of high volume manufacturing.
- Discussions are ongoing for third parties to license the technology.

Integran Technologies Inc.

Round 13-2008A

Sector:

Energy Utilization

Project Delivery Completion:

December 2012*

Market Impact Report Due:

December 2014

Total Project Value:

\$4,464,522

SDTC Funding:

\$1,313,284

Leveraged Funding:

\$3,151,238

Consortium Members:

Integran Technologies Inc.

Morph Technologies Inc.

Pratt & Whitney Canada Corp.

University of Toronto

Environmental Benefits:

(primary benefit bolded)

Clean Air

Climate Change

*Project related activities were completed in December 2012, however, final project reporting was completed in 2013.

Project Title:

Environmental Alternative for Hard Chrome Plating

Project Description:

Integran Technologies Inc. demonstrated its Nanovate™ CR nanometal coating process, which was used to manufacture functional metal coatings with sliding wear and corrosion protection in aerospace, automotive shock, and industrial applications. The material properties of Nanovate™ CR make it a suitable alternative to hard chrome in a wide variety of applications. Existing hard chrome plating processes are a workplace concern given the associated health impacts from exposure to chromium, such as lung cancer and nasal septum and skin ulcerations. The Nanovate™ CR coating process avoids the use of chromium and is therefore expected to result in fewer occupational health and safety risks. The Nanovate™ CR process is also more energy efficient than the traditional hard chrome process, resulting in a reduction in greenhouse gas (GHG) and air pollutant emissions.

Objectives:

- Identify applications in aerospace, automotive, and industrial areas where Nanovate™ CR is a good fit for replacing hard chrome plating.
- Demonstrate that Nanovate™ CR meets high level technical requirements through material properties testing.
- Scale-up of the Nanovate™ CR process for low to medium volume parts production by refining the process to meet application requirements and health and safety and environmental regulations.

Results:

- Integran identified a number of applications for Nanovate™ CR, including:
 - Automotive: specialty bearings, spherical bearings, and piston rods for shock absorbers.
 - Aerospace: starter-generator shaft, oil pump shaft, actuator rod and cylinder.
 - Industrial: hydraulic rod and cylinder, casting moulds, brake pistons.
- Nanovate™ CR materials were prepared and tested for composition, microstructure, and hardness. It was verified that the process produced coatings that met material properties specifications.
- An industrial scale process line was installed at Enduro Industries LLC and validated by applying Nanovate™ CR coatings to hydraulic rods, which met requirements for composition, microstructure, and hardness. The process met all environmental and health and safety regulations.

Project Impacts:

- GHG and other environmental emissions associated with the demonstration project were negligible, as only a small mass of Nanovate™ CR was produced.
- The market roll-out of Integran's Nanovate™ CR parts is expected to result in cumulative GHG emission reductions of 34 kt CO₂e in Canada and 524 kt CO₂e in the rest of the world from 2013-2020.
- The roll-out is also expected to result in reductions in: Cr⁶⁺ released to the atmosphere and sewers, production of sludge containing Cr⁶⁺, water consumption, and criteria air contaminant emissions.

Path to Market:

- Integran plans to license the Nanovate™ CR process to companies as a 'drop-in' replacement for traditional electroplating processes, such as hard chrome plating.
- Integran is targeting the automotive, aerospace, and industrial sectors and has already successfully licensed the process for aerospace and industrial applications.

Entropex Ltd.

Round 15-2009A

Sector:

Waste Management

Project Delivery Completion:

December 2012*

Market Impact Report Due:

December 2014

Total Project Value:

\$25,024,389

SDTC Funding:

\$6,330,000

Leveraged Funding:

\$18,694,389

Consortium Members:

Entropex
Proctor & Gamble
Klockner-Pentaplast of Canada
Ideal Pipe Partnership
Stewardship Ontario
City of Guelph
University of Western Ontario

Environmental Benefits:

(primary benefit bolded)

Clean Soil

Climate Change

Clean Air

Clean Water

*Project related activities were completed in December 2012, however, final project reporting was completed in 2013.

Project Title:

Mixed-Rigid Plastics Recovery Demonstration Facility

Project Description:

Canada generates an estimated 345,000 tons of “other” residential plastics each year. Much of this plastic is typically landfilled to avoid contamination and co-mingling with higher value recyclable plastics. To address this issue, Entropex developed and demonstrated its RigidReclaim™ process, an innovative mixed rigid plastic processing plant using near-infrared light to differentiate plastic types along with enhanced washing technology. Plastics were sorted and blended to produce high-quality plastic resins with properties comparable to virgin resins derived from petro-chemical sources. The use of Entropex’s recycled resins reduces the need for production of virgin resins, thereby resulting in greenhouse gas (GHG) reductions, criteria air contamination (CAC) reductions, water conservation and a reduction in solid waste sent to landfill.

Objectives:

- Recover commercially valuable streams consisting of five different resin types: polypropylene (PP) pellets; injection grade polyethylene (PE) pellets; clear polyethylene terephthalate (PET) thermoform flakes; polystyrene (PS) flakes; and, polyvinyl chloride (PVC) flakes.
- Scale-up and integrate the process for continuous consistent production of quality products (80% of recovered resins have comparable properties to virgin material).

Results:

- The facility processed approximately 35,000 t of mixed post-consumer plastics into consistent products of high quality, including approximately: 10,000 t PP; 12,000 t PE; 6,900 t PET; 5,400 t plastic bales for use in kilns; and, 4,200 t waste sent to landfill.
- Entropex successfully demonstrated its RigidReclaim™ process from January 2010 to December 2012, scaling up from an initial annualized production capacity of approximately 2,700 t/yr to a production capacity of 23,000 t/yr.

Project Impacts:

- The demonstration of Entropex’s RigidReclaim™ process resulted in a GHG emission reduction of 82 kt CO₂e. The GHG emission reduction intensity associated with the demonstration was 2.07 t CO₂e per tonne plastics processed.
- The demonstration also resulted in significant reductions in CAC emissions, water consumption, and waste sent to landfill.
- The roll-out of Entropex’s RigidReclaim™ process is expected to result in cumulative GHG emission reductions of 925 kt CO₂e in Canada and 9.3 million t CO₂e in the rest of the world from 2013-2023. The roll-out is also expected to result in reductions in CAC emissions, water consumption, and waste sent to landfill.

Path to Market:

- Entropex is on track to expand the capacity of its Sarnia RigidReclaim™ plant from its current capacity of 30 kt/yr to 60 kt/yr in 2013-2014.
- Entropex is exploring opportunities to construct recycling plants in large urban centres around the world and initially plans to construct plants in the EU, the US and UK

University of British Columbia (UBC)

Round 6-2004B

Sector:

Energy Utilization

Project Delivery Completion:
November 2012*

Market Impact Report Due:
November 2014

Total Project Value:
\$7,299,098

SDTC Funding:
\$2,408,702

Leveraged Funding:
\$4,890,396

Consortium Members:

University of British Columbia
British Columbia Institute of
Technology – Photovoltaic
Technology Centre

Environmental Benefits

(primary benefit bolded)

Climate Change

Clean Air

*Project related activities were completed in November 2012, however, final project reporting was received in 2013.

Project Title:

Advanced High Performance Building Envelope with Integrated Sustainable Energy Components

Project Description:

The University of British Columbia (UBC) demonstrated technology that was installed in the Centre for Interactive Research on Sustainability (CIRS), as one of the first state-of-the-art buildings to target the MNECB-86 performance standard. Using a combined set of sustainable technologies, including 25 kW of integrated photovoltaic panels, solar shading devices, light-shelves for day-lighting, and natural ventilation components including mechanized operable windows and other energy saving components, coupled with an extensive adaptive sensing, monitoring and controls system, this building is a "living laboratory" and demonstration centre for environmentally sustainable building design, technologies and operation.

Objectives:

- To design, build and commission an advanced high-performance building envelope integrating non-conventional energy-saving technologies reducing the energy requirements by 81%.
- To use adaptive sensing, monitoring and control systems to collectively maximize the energy-reducing potential of each system through analysis of real-time building performance data.
- To develop the protocols and simplified heuristics required for dissemination, replication and widespread application.
- To document design and user acceptance of the innovative building systems proposed to articulate results and future improvements in the form of post-occupancy evaluations.

Results:

- UBC CIRS has achieved significant energy savings through three main subsystems:
 - Lighting: through extensive use of day-lighting, exterior shading and the optimization of lighting levels, the energy consumed in this building was reduced by 50% in comparison to a modeled equivalent, resulting in net savings of 51 MWh/yr.
 - HVAC: through increased levels of insulation, improved air distribution and demand-controlled ventilation, the energy consumption was reduced by 29% in comparison to the modeled equivalent, resulting in net savings of 242 MWh/yr.
 - Domestic Hot Water: the introduction of heat pumps, solar hot water loops, and flow restrictors reduced the demand for energy by 15%.
 - A clear path toward being net energy positive has been identified by improving lighting controls, recalibrating the solar hot water system and retrofitting the neighbouring Earth and Ocean Sciences (EOS) heat exchange system to increase the amount of reclaimed heat accepted by the EOS by approximately 200 MWh annually, ensuring the building exceeds the goal of saving 81% energy by late 2014.
- Since February 2012, Honeywell's Enterprise Building Integrator building management systems have been monitoring overall building performance. Optimization is ongoing to improve performance.
- CIRS has become a center of excellence for showcasing environmental technologies and systems that improve energy efficiency, reduce GHG emissions, reduce reliance on municipal potable water systems and reduce waste, contributing to innovation in building design.
- A pre-occupancy evaluation survey conducted before the inhabitants of CIRS moved in is used to track the evolution of well-being, health and productivity. Preliminary results have not been published.

Project Impacts:

- The net result of the deployment of the innovative technologies integrated into the CIRS project is a reduction in annual GHG emissions of 87% (from 158 t of CO₂ in a conventional building to 20 t of CO₂).

Path to Market:

- This project is a showcase building for a number of technologies, systems and processes. UBC will deploy an aggressive outreach program with diffusion and dissemination of the lessons learned at CIRS through technical reports, articles, papers, conferences and symposiums, targeting the public at large as well as building practitioners, including developers, consultants, contractors, building owners and operators, regulators and policy-makers.

Canadian Pallet Council (CPC)

Round 14 2008B

Sector:

Transportation

Project Completion Date

July 2012*

Market Impact Report Due:

July 2014

Total Project Value:

\$2,428,338

SDTC Funding:

\$1,058,755

Leveraged Funding:

\$1,369,582

Consortium Members:

Canadian Pallet Council

Canadian Pallet Council

Members

iLogic Inc.

Environmental Benefits

(primary benefit bolded)

Clean Air

Climate Change

*Project related activities were completed in July 2012, however, final project reporting was completed in 2013.

Project Title:

Electronic Container Transfer (ECT, or “Virtual Transfer”) Project

Project Description:

The Canadian Pallet Council (CPC) and its consortium members developed the Electronic Container Transfer (ECT) technology that allows companies to trade offsetting imbalances of returnable assets, reducing the requirement to transport these assets and reducing greenhouse gas (GHG) emissions. The project developed the enabling technology to allow container tracking system (CTSWEB) users to virtually reconcile returnable asset imbalances instead of physically moving the assets. The ECT system scans the CTSWEB database to identify imbalances that form a loop between multiple partners. For example, if ECT identifies a loop of imbalances from A to B, B to C, and C to A the system finds the maximum mutual imbalance amongst the three companies and establishes an electronic container transfer trading of the mutual imbalances instead of transporting the empty containers. This project has developed the technology to allow the CPC to identify opportunities for its 1150 members to manage regional flows of returnable assets so that the movement of returnable assets under load is maximized and the transport of empty returnable assets is minimized.

Objectives:

- To eliminate or reduce where possible the transportation and handling of empty containers.
- To reduce the supply chain costs, including damage, associated with the return of empty containers.
- To reduce the GHG emissions associated with the transportation and handling of empty containers.
- To reduce costs to help to maintain or reduce final consumer pricing of goods transported in the containers.

Results:

- With regard to the reductions in the transport of pallets the best measure is the reduction in “pallet kilometers (kms)” created by the settlement Electronic Container Transactions. This can be expressed in absolute terms and not in relative terms as the ECT only measures opportunities and actual settlements. It does not calculate the total pallet kms of the entire system as that was beyond the scope of this project. Using data from the November 2013 report, ECT reduced the number of empty pallet kms by 95,527,300. This reduction is equivalent to 2,248 fewer truckloads travelling 100 kms each. These equivalences are based on an average of 425 empty pallets per truckload and are cumulative for the time period from September 2012 to November 2013.
- The planned market for ECT is based on a forecast of 625 CTSWEB locations participating by 2021. These installations will result in 11.6 kt/yr of CO₂, 4,142 gm/yr of SO_x, 121 t/yr of NO_x, 1,218 gm/yr of particulate matter being avoided.

Results:

- The ECT technology will decrease the total number of pallets on the road by an average of 2,808 pallets per day, reduce GHG emission by 13.8 t CO₂e/day, or 187 t CO₂e/million pallets transported.

Path to Market

- The CPC offers the ECT application to its members for free. iLogic, who developed the software, has the rights to the broader software platform which could be used for other applications.

Milligan Biofuels Inc. (formerly Milligan Bio-Tech Inc.)**Round 9-2006A**

Sector:

Energy Exploration and ProductionProject Delivery Completion:
October 2012*Market Impact Report Due:
October 2014Total Project Value:
\$28,141,614SDTC Funding:
\$7,004,493Leveraged Funding:
\$21,137,121**Consortium Members:**Milligan Biofuels Inc.
Saskatoon Transportation
Company (STC)
Saskatoon Transit
(City of Saskatoon)
O&T Farms Ltd.**Environmental Benefits:**

(primary benefit bolded)

Climate Change

Clean Air

*Project related activities were completed in October 2012, however, final project reporting was received in 2013.

Project Title:

System for the Valorization of Distressed Seeds

Project Description:

Milligan Biofuels Inc. demonstrated the first hub (biodiesel production plant) and spoke (for bio-oil and meal production) system for the valorization of distressed canola seed. As part of this project, Milligan developed and optimized a mechanical seed crushing and extraction process to access the oil and meal contained within the seeds, without the use of toxic chemicals common to the industry such as hexane, used in the standard wash process. This oil was converted to biodiesel in a production process developed and optimized by Milligan. The process successfully produced 6ML of biodiesel during the period of November 2011 to October 2012.

Objectives:

- Demonstrate the viability and valorization of a full integration of distressed canola seeds.
- Demonstrate the integration of meal production (through a fractionation that produces a higher value meal) in a biodiesel operation and distressed seed valorization system.
- Demonstrate full scale biodiesel production (10ML/year) from off-grade seeds (30,000 t/yr).
- Demonstrate the enteric methane emission reductions of the resulting animal meal (crushing by-product).
- Run fleet(s) on biodiesel and demonstrate the fuel savings (of 0.1-3%) with the new ultra low sulphur diesel.

Results:

- Milligan's processing economics are favourable and profitability over the coming 5 years is anticipated.
- A distribution agreement with a leading international marketer and distributor of agricultural products, animal feed and specialty chemicals and ingredients, was secured to market and distribute Milligan's canola-based meal product for cattle feed.
- A biodiesel production capacity of ~30,000 L/day (10 ML/year) was regularly produced, with production of more than 50,000L/day achieved. A biodiesel conversion efficiency of 86% was achieved, surpassing their target.
- Based on literature, Milligan Bio-Meal will have a significant impact on methane emission reduction if used effectively in ration formulation: up to a 10% reduction when implemented with high grain feedlot finishing diets, and up to a 20% reduction for high producing dairy cow diets could be expected.
- Following the mandated introduction of 2% biodiesel into the Saskatchewan diesel supply, Milligan was not able to complete transportation trials relating to demonstrating the fuel savings associated with blending Milligan's biodiesel as all diesel sold in Saskatchewan now contains biodiesel and the diesel only baseline is no longer available.

Project Impacts:

- The demonstration of Milligan's hub and spoke system for distressed canola seeds resulted in an emissions reduction of 23,252 t CO₂e over its one year operating period. The emission reduction intensity associated with the demonstration was 3.66 kg CO₂e/L of biodiesel produced. Emission reductions resulted from the replacement of conventional diesel, glycerine and canola meal.

Path to Market:

- Milligan is currently sourcing feedstocks for its biodiesel plant and expects to produce 6 ML of biodiesel in 2013 and then expand production to 18-20 ML biodiesel per year from 2014-2016.
- Milligan intends to license the technology through the formation of partnerships to expand the number of plants across Canada.

St-Jean Photochemicals Inc.

Round 11-2007A

Sector:

Energy Utilization

Project Delivery Completion:

September 2012*

Market Impact Report Due:

September 2014

Total Project Value:

\$5,089,466

SDTC Funding:

\$1,673,424

Leveraged Funding:

\$3,416,042

Consortium Members:

St-Jean Photochemicals Inc.

Konarka Technologies Inc.

NRC – Institute for

Microstructural Sciences

Université Laval,

Department of Chemistry

Environmental Benefits:

(primary benefits bolded)

Climate Change

Clean Air

Clean Soil

*Project related activities were completed in September 2012, however, final project reporting was received in 2013.

Project Title:

Low Cost Printable Organic Solar Cells

Project Description:

The high cost of solar photovoltaic (PV) cells is a major obstacle for wider adoption of solar power generation, a renewable source of electricity that can provide GHG emission reduction benefits by displacing conventional power generation based on fossil fuels. St-Jean Photochemicals teamed up with Université Laval to produce a new polymer derivative that promised to greatly reduce the cost of producing solar PV cells. This unique polymer has higher material stability and light absorption properties than its nearest competition. The aim of this project was to develop a novel manufacturing process for the fabrication of polymer PV cells at a cost of less than \$1.00 USD per Watt peak power (Wp) and with an energy conversion efficiency of 8%.

Objectives:

- Synthesis of new organic polymer materials based on patents developed at Université Laval and NRC.
- Organic polymer PV device design optimization to achieve improved solar cell efficiency.
- Fabrication of polymer chemical materials in an industrial scale process.
- Demonstration of the solar cells in a system context.

Results:

- Several polymers were synthesized with the most promising candidate PCDTBT demonstrating power conversion efficiency (PCE) reaching 4.7% without any optimization. Upon optimization of processing parameters, the PCE reached up to 7.2% with an active layer thickness for the photovoltaic (PV) cell of ~100 nm. At that time, this PCE was among the top 3 in the world. A new class of conjugated polymers based on thieno [3,4-c] pyrrole-4,6-dione (TPD) demonstrating PCE of 8.8% was also developed to target active layers~200nm thick, as required for printing press PV manufacturing.
- The PCE of PCDTBT-based Organic PV cells was improved from 3% to 7% by optimization of the devices' multilayer structure (improved optical absorption), and enhancement of the electronic properties of the active layer via nano-scale morphology control.
- Development of an industrial process for the manufacturing of DOPT, a monomer required for the preparation of PDTSTPD was completed. Optimization work resulted in a process that afforded DOPT a 70% yield without the need for purification by chromatography (reduced cost and production time).
- A system demonstration was not completed as the commercial partner Konarka filed for bankruptcy as a result of the worldwide solar PV price war initiated by China in 2010.

Project Impacts:

- The demonstration of the solar cells did not take place and therefore there were no environmental benefits associated with the demonstration project.
- No plans are currently in place for the market roll-out of the project technology and therefore market roll-out environmental benefits have not been calculated.
- If manufacturing of the organic PV cells were to take place, GHG emissions intensities associated with the production of electricity by the organic solar cells in Canada and the rest of the world are estimated to be 0.24 kg/kWh and 0.27 kg/kWh, respectively.
- When compared with the GHG emissions intensity of electricity produced by conventional PV cells (0.044 kg/kWh), the project organic PV cells would result in an increase in solar electricity production emissions intensities in Canada and the rest of the world of 0.20 kg/kWh and 0.24 kg/kWh, respectively, due primarily to the short lifespan of the project organic PV cells vs. conventional PV.

Path to Market:

- There are no plans to commercialize the project technology at this point due to the bankruptcy of the commercialization partner however, the produced polymer would be available for commercialization should another partner be interested.

Vive Crop Protection Inc.

Round 13-2008A

Sector:

Energy Utilization

Project Delivery Completion:

October 2012*

Market Impact Report Due:

October 2014

Total Project Value:

\$11,038,603

SDTC Funding:

\$3,954,706

Leveraged Funding:

\$7,083,897

Consortium Members:

Vive Crop Protection Inc.
 Neo Material Technologies Inc.
 AMR Technologies Inc,
 a division of NOVA
 Chemicals Corp.
 Cennatek Bioanalytical
 Services
 University of Alberta, National
 Institute of Nanotechnology
 University of Toronto
 University of Western Ontario
 The Royal Institution for the
 Advancement of Learning,
 McGill University

Environmental Benefits:

(primary benefit bolded)

Clean Soil

Climate Change

Clean Air

Clean Water

*Project related activities were completed in October 2012, however, final project reporting was received in 2013.

Project Title:

Vive Formulations of Crop Protection Active Ingredients

Project Description:

Vive Crop Protection developed a nanotechnology platform with applications in cost effective nanoformulations of agricultural chemicals and industrial catalysts. The technology allows for the production of ultra-small nanoparticles that don't agglomerate, thereby reducing the amount of chemical product required for a given application. In agricultural chemical applications, this results in reduced spray water use rates, lower contaminants in the soil, and greenhouse gas (GHG) emission reductions. This three year project involved constructing a manufacturing pilot plant at approximately half industrial scale, optimization of the nanoformulations and manufacturing processes, production and characterization of the products, and field trials of the end products.

Objectives:

- Construct a pilot plant with distinct process lines for crop protection products and industrial catalysts in order to support prototype development, produce samples for testing and demonstrate process scalability.
- Produce crop protection products, demonstrate their efficacy in field trials, and conduct health and safety testing on the products.
- Demonstrate a platform to produce nanocatalysts and demonstrate their improved catalytic activity.
- Complete a final review of crop protection and industrial catalyst product prototypes and make a go/no-go decision.

Results:

- A pilot plant was constructed and demonstrated at a capacity of 5 kg/week for both catalyst and crop protection products.
- Crop protection products were produced and tested. The products required lower application rates, as much as 50% in some cases, for the same efficacy and had no difference in mammalian toxicity when compared with traditional pesticides.
- Nanocatalysts were produced with higher activity than the commercial standard, however performance improvement was deemed insufficient to make this product commercially viable. Product deployment will not be pursued.

Project Impacts:

- The demonstration of the crop protection products resulted in negligible environmental benefits, as only a small amount of products were tested in the field trials.
- The market roll-out of four crop protection products (pyrethroids, difenoconazole, fenoxaprop, and azoxystrobin) is expected to result in cumulative GHG emission reductions of approximately 8 kt CO₂e in Canada and 1.5 Mt CO₂e in the rest of the world from 2013-2023.
- The market roll-out is also expected to result in reductions in CAC emissions and cumulative reductions of agricultural chemicals in the soil of approximately 200 t in Canada and 36,000 t in the rest of the world.
- Vive is currently focusing on commercializing several of their crop protection products globally.

Path to Market:

- Vive plans to commercialize its crop protection products initially in the United States due to shortened regulatory timelines, with Canadian registration and commercial launch in the year following US launch.
- Vive has strong relationships with the six market leading agricultural chemicals manufacturers as well as the major distributors. Vive is currently negotiating distribution agreements with several of these partners.

SWITCH Materials Inc.

Round 17-2010A

Sector:

Energy Utilization

Project Delivery Completion:

September 2012*

Market Impact Report Due:

September 2014

Total Project Value:

\$8,046,780

SDTC Funding:

\$2,363,621

Leveraged Funding:

\$5,683,159

Consortium Members:

SWITCH Materials Inc.
Bing Thom Architects
Light House Sustainable
Building Centre
4D Labs
PFG Glass
British Columbia Institute of
Technology

Environmental Benefits

(primary benefit bolded)

Climate Change

Clean Air

*Project related activities were completed in September 2012, however, final project reporting was received in 2013.

Project Title:

Hybrid Electrochromic/Photochromic Smart Windows

Project Description:

SWITCH Materials Inc. developed a hybrid photochromic/electrochromic Smart Window film. This Smart Window darkens when exposed to sunlight and lightens in response to an electric charge with a switching time of 30 to 60 seconds. The technology is based on a novel group of stable organic chromophores that have both photochromic and electrochromic properties. SWITCH's Smart Window film reduces the solar heat gain coefficient of the window (compared to industry standard low-e double glazed windows), which may reduce electricity use by heating, ventilation and air conditioning (HVAC) equipment. Lighting use may also be reduced, as use of daylight will be possible rather than needing to draw blinds to reduce glare on bright days.

Objectives:

- Develop pilot production of SWITCH chromophore formulations.
- Develop pilot manufacturing capability for SWITCH film.
- Improve optical performance to a contrast ratio of 6:1 from 4:1 (in sunlight).
- Achieve target cycling durability of about 20 years (50,000 cycles).
- Achieve target installation cost of \$100/m² (including wiring); and
- Demonstrate energy savings and CO₂e reductions.
- Demonstrate architectural smart windows in a real-world setting.
- Collect user response data for market-readiness analysis.

Results:

- SWITCH built and commissioned a pilot manufacturing line capable of coating the selected hybrid formulation.
- SWITCH finalized engineering, design, and integration of the window film into the SMART Windows.
- SWITCH achieved a 7.5:1 contrast ratio.
- SWITCH achieved a target cycling durability of about 10 years (10,000 cycles).
- Installation costs were \$212/m² due to the hand fabrication and high material costs for low volumes but at commercial scale production levels material costs would reduce to 25% of current material costs achieving installation costs close to the target.
- Energy savings of 7-25% and associated CO₂e reductions can be inferred from performance data collected during the demonstrations.
- Installed 37 architectural smart windows across two locations in the Lower Mainland and monitored data for 1 year.
- Collected user-surveys and performed end-of-project interviews that led to a strategic shift in path-to-market focus.

Project Impacts:

- GHG and air emission reductions resulted from reduced consumption of electricity.
- GHG emissions reductions associated with the demonstration project were 4.74 kg CO₂e/m²/year.
- Additional reductions in CAC emissions for the demonstration project were: 0.0581 kg NO_x/m²/year; 0.0921 kg SO_x/m²/year; 0.0062 kg PM/m²/year.

Path to Market:

- During the project SWITCH determined from gathering performance data and user feedback that the technology would not meet the user needs and long term durability requirements necessary for widespread adoption in the architectural application in the near term. In addition, SWITCH identified characteristics of the technology where there was a distinct advantage over competitive technologies in the automotive space. SWITCH is currently pursuing a market strategy targeting automotive glazing for the first commercial product, as a technology stepping stone to the architectural market. Technology improvements in the course of commercializing an automotive product will inform and contribute to the development of the architectural product.

Middle Bay Sustainable Aquaculture Institute

Round 10 - 2006B

Sector:

Agriculture

Project Delivery Completion:
June 2012*

Market Impact Report Due:
June 2014

Total Project Value:
\$11,945,628
(pending final audit)

SDTC Funding:
\$3,645,291

Leveraged Funding:
\$8,300,337

Consortium Members:

Middle Bay Sustainable
Aquaculture Institute (MBSAI)
Gordon and Betty Moore
Foundation (GBMF)
Coast Sustainability
Trust (CST)
Middle Bay Ltd.
Partnership (MBLP)

Environmental Benefits (Primary benefit bolded)

Clean Water
Clean Soil

*Project related activities were completed in June 2012, however, final project reporting was received in 2013.

Project Title:

Floating solid wall containment system

Project Description:

The Middle Bay Sustainable Aquaculture Institute project intended to further explore and demonstrate the use of commercial-scale solid wall containment systems, incorporating waste recovery, for salmon aquaculture. This technology has the potential to increase the rearing capacity of the Canadian and global salmon farming industry, by allowing for sustainable aquaculture growth in coastal communities while minimizing interference with marine environments.

Objectives:

To demonstrate:

- the technical, biological, environmental and economic feasibility of the floating solid wall containment system at a commercial scale in the production of saleable salmon.
- the operation of four commercial scale (24 and 30 meter diameter) salmon rearing tanks, each hosting a 12 to 20 month salmon grow-out period resulting in at least one harvest per 24 meter tank, 12 months rearing time in at least one of the 30 meter tanks, 10 months operation and monitoring of the integrated four tank system and a total production of approximately 0.8 million kilograms of market ready fish.
- full cycle fish mortality rates at or below 10%, which is the current industry standard.
- the development and effective implementation of Standard Operating Procedures (SOPs) to prevent the outbreak of disease and sea lice, resulting in the development of an optimal data collection and recording sheet, and optimized SOPs outline.
- 25% less energy consumption than comparable land-based and net cage operations on a kW/kg biomass basis.
- the sludge end product is compostable and/or beneficially usable as a similar product. The volumes of sludge collected, and its manner of beneficial use or disposal will be recorded.

Results:

- MBSAI installed one tank and stocked it with 55,000 smolts in January 2011. However, in March 2012, a severe storm hit Campbell River and the tank was damaged to the extent the fish had to be harvested immediately. MBSAI managed to harvest approximately 45,000 of the 55,000 fish initially put in the tank. The fish were sold at market rates to their partner Safeway for distribution in the U.S. The average weight of the premature harvest was about 2 kg vs the original target of 3.5 kg. Fish health was very good and there were lower than expected incidents of disease while processing.
- Since the remaining three tanks were not constructed and installed within SDTC's five-year funding period other metrics could not be collected. The project has been sufficiently de-risked to attract private sector investors. The new investor has committed to providing results of the project to SDTC and to make publicly available their findings.

Project Impacts:

- As the project did not complete all of its objectives within the SDTC prescribed 5 year time frame, there are no project impacts to report.

Path to Market:

- The intent is that the new investor will license the tank technology and sell the fish in their own facility to seafood wholesalers.

CVTCorp Transmission Inc.

Round 10-2006B

Sector:

Transportation

Project Delivery Completion:

June 2012*

Market Impact Report Due:

June 2014

Total Project Value:

\$7,649,865

SDTC Funding:

\$2,131,950

Leveraged Funding:

\$5,517,915

Consortium Members:

CVTCORP Transmission Inc.

AGCO Corp

Case New Holland America
LLC

Natural Resources Canada
- Efficiency & Energy
Alternative Program (Office
of Energy Efficiency)

Environmental Benefits

(primary benefit bolded)

Clean Air

Climate Change

*Project related activities were completed in June 2012, however, final project reporting was received in 2013.

Project Title:

Demonstration of a Pre-commercial Toroidal-Based CVT on Heavy Agricultural Off-Road Vehicles

Project Description:

CVTCorp Transmission Inc. has developed an innovative high efficiency toroidal continuously variable transmission (CVT) and an associated automatic control system, enabling adjustment of engine speed and ratio as a function of power demand. A toroidal CVT is made up of discs and rollers, which vary the ratio and transmit power between discs. CVTs enable engines to operate either at their most efficient revolutions per minute (RPM) over a range of vehicle speeds or at an RPM that produces peak power. Advantages of CVTs include reduced fuel consumption, increased efficiency, increased engine life span as well as enhanced productivity and drivability of off-road vehicles.

Objectives:

- Adapt the original CVTCorp VariGen™ technology for use in a combine harvester header/feeder subsystem.
- Integrate the adapted prototype into one CNH 150 HP model and two AGCO combine harvesters, 150 HP and 240 HP models.
- Test and quantify the machine productivity gain and fuel savings in the lab and in the field.
- Demonstrate commercial viability through long-term reliability testing.

Results:

- CVTCorp designed and fabricated an alpha CVT prototype (D10) which was successfully tested, along with a planetary gearbox, on a dynamometer and on a Case New Holland combine header drive in the field in 2009. The performance of the system was proven with an average efficiency of 95%.
- CVTCorp designed and fabricated two beta CVT prototypes (D8). The efficiency of the beta prototype was confirmed to be 94%; however, the beta prototypes failed the durability test and further work could not be carried out on the AGCO combine harvesters at that time.
- Based on the anticipated 10% efficiency improvement of the header/feeder subsystem, the expected reduction in fuel consumption was approximately 3.14 L/hr.
- The final part of the project was to validate the beta prototypes, which required the CNH application to pass 1200 hours of lab-scale validation before being tested directly in the combine harvesters in the field. The beta prototype failed at 215 hours due to a failure of the bearings in the rollers and at 402 hours due to a rolling surface failure. Given that the laboratory tests were not completed, further work could not be carried out during the project period. CVTCorp continues to validate the technology beyond the SDTC project period.

Project Impacts:

- Once integrated into a combine manufacturer's assembly line, this technology will reduce the diesel fuel consumption of a combine harvester by 25%.
- GHG emissions reductions associated with the one unit in one combine harvester over one year (1200 hours) were estimated to be 11.33 t CO₂e/year. Over the next 15 years, cumulative emission reductions were estimated to be 170 t CO₂e.

Path to Market:

- The D10 design is being refined to meet cost and reliability targets for a number of markets (including the agricultural/combine market). CVTCorp is developing key partnerships for integration of their CVTs into manufacturing lines worldwide with combines and tractor applications being the main focus.
- Market projections for the combine header drive market are estimated to be 350 units in 2016, increasing to 1360 units by 2023 and maintaining sales of 1360 units until 2028. The channel to market is through AGCO Corp and Case New Holland America LLC. These projections are based on historical sales of combine harvesters in Canada, the United States, North and South America and Europe.

Turbo Trac Systems ULC Inc.

Round 10-2006B

Sector:

Energy Exploration and Production

Project Delivery Completion:
January 2012*

Market Impact Report Due:
January 2014

Total Project Value:
\$4,201,622
(pending final audit)

SDTC Funding:
\$188,934

Leveraged Funding:
\$4,012,688

Consortium Members:
Turbo Trac Systems ULC
Lufkin Industries

Environmental Benefits:
(primary benefit bolded)
Climate Change
Clean Air

*Project related activities were Early Terminated in January 2012 due to commercialization. Final reports were received in 2013. SDTC's mandate does not fund commercialization. This project forecasts strong environmental benefits over the next 10 years.

Project Title:

Infinitely Variable Transmission (IVT) Technology for Oil Well Pumping Systems

Project Description:

Turbo Trac Systems ULC (Turbo Trac) developed their Infinitely Variable Transmission (IVT) as a unique innovation to overcome the constraints of current speed control methods in pumping applications. In oil and gas applications, the IVT is mounted between the prime mover (motor) and the pump jack. It provides a seamless and infinitely variable change in speed to the pump (variable torque) without any interruption in power throughput, allowing each unit to operate at its most efficient speed. This results in an overall system efficiency improvement of at least 10% when compared to pump jacks driven by variable frequency drives (VFDs). The IVT technology results in GHG emission reductions by reducing pumping system electricity usage.

Objectives:

- Investigate, design, detail, build and test an IVT prototype for a 50 hp pump application and complete bench and field testing.
- Design, detail, build and test an IVT prototype for 100+ hp pump application.
- Demonstrate the field application of four IVT prototypes on 100+ hp pump jacks operating at oil wells in Texas and Alberta.

Results:

- Design, manufacturing, and field testing were completed for an IVT prototype with a 50 hp pump application. The prototype met the technical performance criteria. The design was revised so that the prototype could operate with pumps of various powers, including 50 hp, 75 hp, 100 hp and 125 hp pumps. Test designs indicated that the redesigned versions improved performance and commercial viability. The redesigned prototype was fabricated and field tests were carried out on both electric and internal combustion engine powered pump jacks in California and Texas.
- Field tests were not carried out in Alberta, but three units were tested in cold weather conditions in North Dakota.
- It has been demonstrated that IVT reduces energy consumption, operating and installation costs. The technology is more robust therefore reducing maintenance and repair costs

Project Impacts:

- The installation of Turbo Trac's IVT technology on electric pump jacks has the potential to result in GHG emissions reductions of 0.18 t CO₂e/oil well/yr of operation. This will also result in small reductions in CAC emissions of approximately 1.4 kg TPM, 0.3 kg SO_x, and 0.2 kg NO_x per well per year.
- If the IVT technology is installed on 350,000 wells in the United States, this would result in GHG emissions reductions of approximately 625 kt CO₂e over 10 years. This would also result in CAC emissions reductions of 5,000 t TPM, 1,200 t SO_x, 700 t NO_x, 257 t CO, and 12 t VOCs.

Path to Market:

- Turbo Trac is currently commercializing its IVT technology. The technology is focused on the North American oil and gas market with oil well pumps as its first targeted application. One of their customers- Card Board Paper Mill is currently saving \$5,500 annually due to installation of IVT on one of the 10 roll stands. In addition, Turbo Trac is offering its prospective customers the opportunity to test out their units in their own environment prior to purchasing.
- Turbo Trac's products may be applied to approximately 25% of all existing and new wells; or about 350,000 wells in the United States over the next five years. Turbo Trac plans to grow from less than \$500,000 in revenue in 2012 to approximately \$30 million in 2017.

General Electric Canada

Round 9-2006A

Sector:

Energy Utilization

Project Delivery Completion:
November 2011*

Market Impact Report Due:
November 2013

Total Project Value:
\$7,456,183

SDTC Funding:
\$2,485,395

Leveraged Funding:
\$4,970,788

Consortium Members:

GE Canada
GE Multilin
BC Hydro
(incl. Powertech labs)

Environmental Benefits (primary benefit bolded)

Climate Change
Clean Air
Clean Water
Clean Soil

*Project related activities were completed in November 2011, however final project reporting was completed in 2012.

Project Title:

GE Canada - Hybrid Renewable Energy Systems

Project Description:

Greater than 293 remote communities in Canada are not connected to power grids or gas pipelines. Most rely mainly on high-cost diesel fuel for their power. This project demonstrated the Renewable Microgrid System (RMS) that will enable remote communities to achieve a high penetration of renewable energy sources. The RMS applications included local and supervisory controls, protection, coordinated power generation, and energy storage and load management. An electrolyzer to produce hydrogen, a hydrogen storage system, power generation via fuel cells and an energy storage system were the components to be integrated and incorporated in a microgrid demonstration proposed for Bella Coola, BC.

Objectives:

- Develop a renewable energy system for remote communities consisting of a Microgrid Control System (MCS) and hydrogen energy system.
- Reduce diesel consumption by a minimum of 0.75% through storage of additional hydro power with the hydrogen system and Vanadium Redox Battery (VRB).
- Demonstrate the individual technologies - MCS, hydrogen energy system and VRB electrochemical energy system - for potential integration into other remote communities on a larger scale.

Results:

- The MCS and hydrogen energy storage loop, comprising the electrolyzer, compressor and fuel cell generator were successfully developed and operated. BC Hydro clients in Bella Coola, BC, were supplied with electricity generated using the hydrogen fuel cell.
- The total duration of fuel cell operation during the project reporting period was approximately 200 hours.
- Demonstration of the VRB was not completed, as the company that was to supply the VRB ceased operations before the equipment was delivered. Substitution of the VRB with an alternative energy storage system was not possible within the project timeframe.

Project Impacts:

- The demonstration project resulted in an increase in GHG emissions over the baseline of 3 t CO₂e, since the limited reduction in emissions associated with reduced diesel fuel use during 200 hours of operation was outweighed by the emissions associated with material production and transportation of the system to the demonstration site.
- If the system had been operated for extended periods, avoided diesel fuel emissions would have been 82 t CO₂e / yr.

Path to Market:

- GE plans to roll out the MCS independently of the other technologies associated with this demonstration project and has recently introduced the controller to the market under the product name Grid IQ™ Microgrid Control System. GE is now actively pursuing commercial microgrid projects in North America and around the world.

Market Impact:

- GE has been developing numerous microgrid opportunities since the commercial launch of this technology.
- GE has won two projects in the United States with five potential new customers in the pipeline for 2014.
- GE is actively working on numerous other proposals and offers for microgrid projects in North America as well as globally.

EcoVu Analytics Inc.

Round 8-2005B

Sector:

Energy Utilization

Project Delivery Completion:
November 2011*

Market Impact Report Due:
November 2013

Total Project Value:
\$3,165,715

SDTC Funding:
\$1,035,555

Leveraged Funding:
\$2,130,159

Consortium Members:

EcoVu Analytics Inc.
Ontario Ministry of Environment
City of Ottawa
Carleton University
HROSE Machining Ltd
Quinte Conservation Authority
Laser Diagnostic Instruments
CRIFS

Environmental Benefits

(Primary benefit bolded)

Clean Water

*Project related activities were completed in November 2011, however final project reporting was completed in 2012.

Project Title:

Ultra – Trace Level Water Contaminant Concentrator

Project Description:

EcoVu Analytics demonstrated an improved water quality monitoring system utilizing a technology that concentrates contaminants in the monitoring device. The patented concentration process allows for timely, more efficient and reliable detection thereby optimizing the measurement of low-level microbiological and chemical pollutants. The technology is initially targeting voluntary testing for health and safety applications (drinking water treatment plants, in-field surface water sampling, and laboratory analysis). EcoVu's near real-time analysis results can enable water treatment plants to optimize plant operations and reduce chlorine use.

Objectives:

- Develop and demonstrate a portable device to concentrate contaminants from relatively large sample volumes of water to facilitate the capture, detection and enumeration of very low concentration (parts per billion) contaminants. The device consists of the RC1000™ that collects the water sample and holds the disposable Ultra-Trace Cartridge (UTC™) that concentrates the contaminants.
- This enabling technology will allow water utilities to provide more secure systems through higher frequency monitoring at lower detection limits and potentially improve treatment plant efficiency by optimizing operations.

Results:

- Developed and tested a portable device to concentrate contaminants from relatively large sample volumes of water to facilitate the capture, detection and enumeration of very low concentration (parts per billion) contaminants. The system, utilizing 200 mg cartridges containing the EcoTrap concentrator medium, has undergone a variety of trials to concentrate a variety of contaminants including:
 - 4 log removal of MS2 bacteriophages
 - 4 log removal of dioxins at flow rates of 100 ml/min and flow volumes of 10 - 150L

Project Impacts:

- EcoVu's product is an enabling technology thus:
 - Potential GHG emissions reductions associated with the demonstration project were estimated to be 68 t CO₂e/year for one unit.
 - Potential additional reductions in CAC emissions for one unit were estimated to be: 105 kg SO_x/yr; 80 kg NO_x/yr; 8 kg PM/yr; 22 kg CO/yr; and 9 kg VOC/yr.
 - Potential further impacts per unit include a reduction of 246 kg THM in water per year and a reduction of 63 ML/year of contaminated water (with bacteria or protozoa).

Path to Market:

- Upon project completion EcoVu decided to pursue the scale-up of the technology for the purposes of remediation rather than concentration for subsequent detection and analysis. Therefore, RC100 will not be rolled out commercially, thus no sales are projected for the technology as developed during the SDTC project.

Market Impact:

- As noted above, upon project completion, EcoVu decided not to roll the RC100 product out commercially, hence, no direct market impact is expected.

Enerkem Inc.

Round 9 - 2006A

Sector:

Waste Management

Project Delivery Completion:

November 2011*

Market Impact Report Due:

November 2013

Total Project Value:

\$17,147,261

SDTC Funding:

\$2,660,476

Leveraged Funding:

\$14,486,785

Consortium Members:

Enerkem Inc.

Greenfield Ethanol Inc.

Tred'Si Inc.

Environmental Benefits:

(primary benefit bolded):

Climate Change

Clean Air

*Project related activities were completed in November 2011 however, final project reporting was completed in 2012.

Project Title:

Sustainable Alcohols Facility

Project Description:

A sustainable alcohols facility was erected in East Angus, QC, which made use of a gasification process to convert biomass such as municipal solid waste, sludge, treated wood waste, and construction and demolition wood into alcohols (methanol and ethanol). The facility was also able to process residual forest and agricultural biomass. The demonstration plant was designed to treat 12,000 tonnes of biomass-rich residues per year and produce 4 million litres of alcohols per year. As a result of this successful demonstration, a commercial plant is currently being commissioned in Edmonton, AB. This full-scale commercial facility is designed to produce 38 ML per year of ethanol and similar commercial projects are being developed in Varennes, QC and Pontotoc, Mississippi. Construction of the Varennes facility is scheduled to begin in 2014.

Objectives:

- Demonstrate, at an industrial scale, the economic production of methanol from low cost biomass (waste wood).
- Demonstrate, at an existing facility, the production of bioethanol via two approaches: (i) methanol to ethanol conversion; and (ii) direct synthesis, from syngas, of a mixed alcohol rich in ethanol.

Results:

- Enerkem successfully demonstrated the industrial scale production of methanol from wood waste. The project reduced GHG emissions primarily through the diversion of wood waste, which is typically sent to landfill where it decomposes, releasing methane.
- Although ethanol was produced in a batch basis, the second project objective of 0.2 t/hr production of ethanol from methanol and/or syngas was not completed within the SDTC project timeframe.
- The construction of the full-scale cellulosic ethanol facility in Varennes, QC is scheduled to begin in 2014.
- Enerkem is also developing additional commercial projects in North America, such as in the State of Mississippi, and globally.

Project Impacts:

- Total GHG emissions reductions associated with the demonstration project were estimated to be 1.32 kt CO₂e, with a reduction intensity of 34 kg CO₂e per liter of methanol produced.

Path to Market:

- Enerkem is bringing its methanol production technology to market with a commercial scale facility in Edmonton, AB beginning production in 2014. An ethanol module will follow, and the construction of another cellulosic ethanol facility in Varennes, QC, will begin in 2014.

Market Impact:

- As a development stage company, meaningful sales of Enerkem 's products have not yet occurred. Revenue to date has primarily consisted of facility testing fees.
- While Enerkem's prime focus is the commercial production of cellulosic ethanol, they also intend to expand to multiple products beyond ethanol by taking advantage of their ability to produce a pure, chemical-grade syngas that serves as a key intermediate for the production of renewable chemicals.
- Future revenues are expected from the sales of biofuels and biochemicals, as well as payments, commonly referred to as tipping fees, which Enerkem expects to receive from municipalities and waste managers for taking municipal solid waste (MSW) as feedstock for their facilities.
- Enerkem's first standard 38 MMLPY commercial facility is currently under construction in Edmonton.
- In addition to projects where Enerkem will build, own and operate, they intend to capitalize on additional opportunities to sell systems utilizing their proprietary technology platform to select strategic partners globally.

Whitefox Technologies Canada Inc.

Round 4-2003B

Sector:

Energy Exploration and Production

Project Delivery Completion:
August 2011*

Market Impact Report Date:
August 2013

Total Project Value:
\$6,983,099

SDTC Funding:
\$2,608,545

Leveraged Funding:
\$4,374,554

Consortium Members:

Whitefox Technologies
Canada Inc.
Poundmaker
Agventures Inc.
Virtual Materials Group

Environmental Benefits:

Climate Change
(primary benefit bolded):
Clean Air

*Project related activities were completed in August 2011, however final project reporting was completed in 2012.

Project Title:

Efficient Production of Fuel Ethanol to Reduce GHG and CAC Emissions

Project Description:

Whitefox Technologies Canada Inc.'s project involved the development and demonstration of a membrane technology for dehydration of hydrous ethanol, mole sieve regenerate and fusel oil draws which can increase production capacity and decrease energy consumption reducing the overall cost of ethanol production in most ethanol plants by up to 3.5 cents per litre (depending on price of natural gas). In Canadian ethanol production, a grain-based feed is fermented, separated and distilled. Conventional approaches using molecular sieve beds or plate and frame membrane filters for moisture removal are less efficient. The Whitefox process is continuous, can dehydrate problematic side streams (e.g. fusel oils) and is less energy intensive -- resulting in lower GHG emissions and improved air quality.

Objectives:

- Demonstrate Whitefox's membrane technology for effectiveness and robustness in operation.
- Reduce cost of ethanol production process to 1.1 kg steam per liter of industrial ethanol (kgS/IE).
- Optimize the costs of manufacturing the membrane for both complete and replacement components.
- Demonstrate the technology at industrial scale.

Results:

- Whitefox successfully built, installed and demonstrated their stand-alone, modular Ethanol Dehydration Skid (EDS-1) on a slipstream of hydrous ethanol at the Poundmaker ethanol plant achieving the following results:
 - The EDS-1 tests have shown that ethanol concentrations of 75w% can be consistently dehydrated to purities of 99.9% and higher (100% in hydrometer readings).
 - Based on these results, models of the WFX80 process (full-scale commercial deployment on the entire plant, not just a slipstream) indicate unparalleled energy efficiency of approx. 1.1-1.3 kg of steam per liter of ethanol (kgS/IE), an improvement of 25% over most modern ethanol plants currently in operation (1.8 kgS/IE).
 - The average North American producer stands to save approximately 11% of their production costs (after capital, feedstock costs) based on a natural gas price of \$3.57 USD/MMBTU.
 - The EDS operated under stable conditions, with a feed which was high in acidity and sulfate under the required pressure, with the targeted quantities (2M L ethanol/yr) and the permeate concentrations required to achieve the target economics.

Project Impacts:

- Impacts from modular, skid-based installations on the mole sieve regenerate vapour permeate stream alone (not a fully integrated process) will result in emission reductions of 0.09 kg CO₂e/l of ethanol produced while increasing plant production capacity and demonstrating customer savings.
- A fully integrated WFX80 system would reduce emissions to 0.5 kg CO₂e/l of ethanol produced.

Path to Market:

- An upgraded version of the EDS (8M l ethanol/yr) was designed and built to validate economic and operational assumptions, allowing customers to gain firsthand experience to be able to make larger investment decisions.
- Whitefox is currently developing projects in North and South America and Europe.

Market Impact:

- The EDS has demonstrated how the technology improves efficiencies and removes process bottlenecks.
- The project has been instrumental in generating significant customer interest in key markets.
- By dehydrating the molecular sieve regenerate stream with Whitefox technology ethanol plants can increase output capacity by 10-20%. This could add significant production capacity, helping the industry to take advantage of 2nd Gen developments and adding billions of dollars in additional revenues for producers.

Power Measurement Ltd.

Round 8 2005B

Sector:

Energy Utilization

Project Delivery Completion:

June 2011*

Market Impact Report Due:

June 2013

Total Project Value:

\$9,104,666

SDTC Funding:

\$2,960,871

Leveraged Funding:

\$6,143,795

Consortium Members:

Power Measurement Ltd.

British Columbia Institute of
Technology

Brookfield Properties

Management Corp.

Schneider Electric Ltd.

Environmental Benefits:

(primary benefit bolded)

Climate Change

Clean Air

Clean Water

*Project related activities were completed in June 2011, however final project reporting was completed in 2012.

Project Title:

ION Enterprise Energy Management (EEM) System Demonstration Project

Project Description:

Power Measurement Ltd. (PML), now a wholly owned subsidiary of Schneider Electric, developed an Enterprise Energy Management (EEM) system to continually collect and analyze the amount of energy and/or materials used by specific processes and pieces of equipment. This technology is expected to facilitate more informed decisions about energy and water conservation strategies, leading to reductions in energy and water use and, consequently, GHG and CAC emissions.

Objectives:

- Validate PML's prototype EEM technology in applications covering the full market spectrum while reducing the cost of EEM ownership through initiatives such as the implementation of wireless technologies.
- Increase system reliability and scalability, and build the correct feature set to accomplish energy efficiency and emission reduction goals. Demonstrate real time intelligent and automated data gathering, cleansing, archiving, storage, backup, analysis, modeling, forecasting and informative energy / environmental / billing reports.
- Demonstrate that information provided by EEM can be used by enterprises to achieve reductions in consumption of water, gas and electricity by 5%, 7% and 10-15% respectively.

Results:

- EEM systems were installed at three sites representing the market spectrum: PML Saanichton (industrial), BCIT (institutional) and Brookfield Place (commercial). The full range of desired functions and features were demonstrated including using wireless technologies.
- A full feature set was built to achieve real-time intelligent and automated data gathering, analysis, forecasting etc. so that customers could act on data in real time to achieve energy savings.
- Energy use was monitored for three years at the first two of the sites and for six months at the third. Water and gas use were also monitored at the first site. Electricity use dropped by 19.5% and 2.2% at the first two sites, but was unchanged at the third. Water use dropped by 5%. Gas monitoring was only done at one site. It identified a malfunctioning boiler and that the air conditioning and heating systems were working sub optimally. After new controls were installed the gas savings were on the order of 20% and the retrofit would pay for itself in 14 months as a result.

Project Impacts:

- The EEM system was instrumental in identifying various opportunities for reducing energy use. In the case of older buildings, these opportunities are projected to reduce electricity consumption by 10-25%. In newer buildings, such as the commercial site monitored in this project, savings of 5% are possible.
- The reduction in water use of 5% observed in this project is expected for typical commercial system installations.
- The project also showed how monitoring could uncover equipment faults, such as boiler malfunctions. In the project's example, the estimated impact of repairs and other energy savings measures was a 20% reduction in gas use.
- Based on PML's market assumptions, and assuming a 5% electricity savings in buildings with EEM systems, annual worldwide GHG savings would be 32 kt in 2020.

Path to Market:

- The path to market is through direct sales of the EEM software with or without meters manufactured by PML. PML expects to sell 10-15 base systems in 2013. They anticipate a 10% increase in sales over the next three years.

Market Impact:

- In 2013, large EEM systems were sold to Verizon, Veterans Affairs (US), BBVA (large bank in Spain), Environmental Protection Agency (US), University of Alberta, Wilfred Laurier University, Chilquinta Energie in Chile, BCE and Honda Canada. PML continues to focus sales to large Enterprise customers.

Nutriloc Ingredients Corp.

Round 8 2005B

Sector:

Energy Utilization

Project Delivery Completion:

June 30, 2011*

Market Impact Report Due:

June 30, 2013

Total Project Value:

\$2,404,493

SDTC Funding:

\$847,319

Leveraged Funding:

\$1,557,175

Consortium Members:

Nutriloc Ingredients Corp.
SunRich Fresh Foods Inc.
Spagnol's Wine and Beer
Making Supplies Ltd.

Environmental Benefits

(primary benefit bolded)

Climate Change

Clean Air

Clean Soil

*Project related activities were completed in June 2011 however, final project reporting was completed in 2012.

Project Title:

Modular Vacuum Microwave Drying Unit

Project Description:

Nutriloc Ingredients Corp. and its consortium partners intended to demonstrate a technology to dehydrate fruits, vegetables and other products with superior cost efficiency and quality compared with freeze drying – the current industry standard. The benefits of the Nutriloc™ system were to include better dried products in terms of flavour, taste, colour and nutrient value but also lower energy use and reduced greenhouse gas emissions. Nutriloc planned to design a portable drying unit that could be trucked to farms and food processing plants, eliminating transportation costs associated with hauling “wet” produce to a central factory.

Objectives:

- To employ a combination of off-the-shelf equipment combined with process engineering and a proprietary programmable logic control system to produce a final product with the following characteristics:
 - Product retains a higher nutrient content than air-drying processes.
 - For whole products such as blueberries, the product will be “puffed” in the drying stage helping it retain its original shape (i.e., grapes will look like a grape instead of a raisin).
 - Products are heated quickly early in the drying process (Infrared - IR) to a sufficient temperature to destroy bacteria meeting food safety requirements.
- Demonstrate a potential for a 30% return on capital investment on a 454 kg/hr capacity system (processing 2.25M kg/yr).
- Validate economic viability by securing expressions of interest from a minimum of two potential customers (for products other than grape skins) confirming quality standards and purchase price of product produced by Nutriloc.

Results:

- Testing during this project was performed using third party equipment to validate the process.

Project Impacts:

- Once commercial, it is projected that for a typical Nutriloc system GHG emissions will be reduced by 0.43 t CO₂e / t H₂O removed

Path to Market:

- Further development of technology is required before Nutriloc can enter the market.

Market Impact:

- The company operations are on hold and as such there are no market impacts to report.

Terragon Environmental Technologies Inc.

Round 10-2006B

Sector:

Waste Management

Project Delivery Completion:

June 2011

Market Impact Report Due:

June 2013

Total Project Value:

\$4,097,783

SDTC Funding:

\$1,592,500

Leveraged Funding:

\$2,505,283

Consortium Members:

Terragon Environmental Technologies Inc.

Department of National Defense and the Canadian Forces

Fairmont Le Château Montebello

US Department of Naval Research

Environmental Benefits

(primary benefit bolded)

Clean Soil

Climate Change

Clean Air

Clean Water

Project Title:

Demonstration of the Micro Auto Gasification System (MAGS)

Project Description:

Environmental and public health concerns have been mounting in northern communities, tourist resorts, and various enterprises due to increasing challenges dealing with waste. Terragon has responded to this problem by developing a Micro Auto Gasification System designed to convert mixed waste into carbonaceous ash and a clean gas fuel which can be used to power the waste treatment system and provide additional energy to the user. Terragon successfully demonstrated their technology in a large hotel and on a naval ship.

Objectives:

- Develop and demonstrate the MAGS technology in multiple locations for the elimination of waste.
- Treat up to 1.2 t/week of solid waste (biomedical and sewage sludge) at the Terragon lab facility.
- Meet municipal and provincial incinerator emission targets for CO, HCl, NO_x, SO_x, particulates, dioxins and furans.
- Produce a volume of char that is less than 20% of the original volume of waste.

Results:

- Successfully treated waste composed of a range of material including paper, cardboard, plastics, food, wood, rags, as well as incidental items generated by the demonstration sites (e.g. oil filters, shoes, electronics).
- Successfully processed 3.2 t of waste at the hotel site, and 6.4 t on the naval ship representing 2.0 t/wk, and 1.6 t/wk respectively.
- Gaseous emissions of CO, SO_x, NO_x, HCl, particulates, metals and dioxins/furans were well below the limits set by the City of Montreal, the Ministère du Développement Durable de l'Environnement and the Marine Environment Protection Committee regulations for incinerators.
- Typical volume of char was 4-5% of the original waste volume, and usable as a soil amendment.

Project Impacts:

- During the project period MAGS reduced GHG emissions by 3.8 t CO₂e at the hotel site, and by 4.8 t CO₂e on the naval ship achieving total GHG emission reductions of 8.6 t CO₂e.
- On average, annual GHG emission reductions are expected to be 0.6 t CO₂e/t MAGS waste processing capacity deployed in Canada and 0.73 t CO₂e/t of MAGS waste processing capacity deployed in the rest of the world.

Path to Market:

- MAGS has been validated to be cost effective remote treatment of solid waste with minimal residue and negligible environmental impact in real world applications.
- Terragon is marketing the technology to individuals, groups and businesses and will be rolling out several MAGS units for both marine and on land applications beginning in 2012.
- Primary target markets are marine (ships, rigs) and military/security (naval/coast guard ships, army bases, expeditionary forces, embassies, borders, prisons). Secondary target markets are hotels, resorts, work camps, hospitals, airports and remote communities.
- GHG emission reductions based on the forecasted market rollout are expected to reach 117 kt CO₂e/year in Canada and 2.6 Mt CO₂e/year in the rest of the world by 2020.

Market Impact:

- To date, the MAGS technology has been well received in the targeted market sectors. These include the Commercial Marine Market, Military and Security Market with installations by the U.S. Marine Corps for support of MAGS operation at Camp Smith and a new contract issued for a Containerized MAGS V6 delivered in November 2012. Terragon is currently in discussions with a number of hotels and resorts, resource exploration work camps and biomedical and pharmaceutical waste organizations.

Chinook Mobile Heating and Deicing Ltd.

Round 8 2005B

Sector:

Transportation

Project Delivery Completion:

June 2011

Market Impact Report Due:

June 2013

Total Project Value:

\$7,378,282

SDTC Funding:

\$3,063,766

Leveraged Funding:

\$4,314,516

Consortium Members:

Chinook Mobile Heating &
Deicing Corp.
Hovey Manufacturing
Flakt Coiltech Inc.
Transport Canada

Environmental Benefits

(primary benefit bolded)

Climate Change

Clean Air, Clean Soil

Project Title:

Tempered Steam Technology for Aircraft Defrosting & Deicing

Project Description:

Chinook Mobile Heating and Deicing Inc. demonstrated an innovative aircraft deicing technology that significantly reduces the environmental, economic and health costs of deicing compared to existing methods employing glycol. The Tempered Steam Technology (TST) uses heated, steam-infused air to melt ice on aircraft surfaces, then heated air alone for drying. The technique can be performed at the gate, reducing aircraft fuel usage incurred during live, engine-on deicing operations while providing operational cost savings to airport operators. The process eliminates GHG emissions from engine idling and from the oxidation of unrecovered glycol. Currently, more than 20 million litres of glycol-based fluids are used annually in Canadian winter operations.

Objectives:

- Develop and demonstrate aircraft defrosting and de-icing units for use in small airport applications, on regional jets, and on narrow and wide body commercial aircraft.
- Reduce the amount of glycol used for de-icing and jet fuel consumption.
- Reduce environmental (air, soil and water) impacts and health risks by demonstrating aircraft de-icing in an operational setting at an airport gate.
- Increase on-time departures for aircraft requiring de-icing.
- Lower operational costs of the TST system relative to current glycol de-icing.
- Introduce TST into its first aviation marketplace application - defrosting of regional jet aircraft.

Results:

- Successfully developed and demonstrated the ADS-4 TST unit for commercial aircraft deicing, and the ADS-6 TST for small airport applications.
- Demonstrated reduced glycol fluid use by 60%, although a larger reduction is expected with improved operator training.
- De-icing aircraft at gate positions reduced the overall consumption of jet fuel.
- Demonstrated that the average time savings per aircraft de-iced was 12 minutes at the Ottawa International Airport and 6 minutes at the Toronto Island Airport.

Project Impacts:

- Environmental benefits arise from reduced use of glycol solutions in aircraft de-icing. During the project period GHG emissions were reduced by 72.4 t CO₂e.
- Each operational ADS-4 TST unit (used at large commercial airports) is expected to reduce GHG emissions annually by 1.3 kt CO₂e while each operational ADS-6 TST unit (used at small regional airports) is expected to reduce GHG emissions annually by 215 t CO₂e.

Path to Market:

- Chinook continues to work to complete the next generation of the Chinook technology which is expected to be commercially available in 2012.
- Finnair has purchased two engine de-icing systems for delivery in 2012.
- Following successful market introduction of the defrosting application, Chinook plans to systematically introduce TST to address other aircraft de-icing applications and operations.
- Chinook has completed some testing on the small aircraft core de-icing technology for high end or specialty situations in urban areas, and on construction sites.
- On an annual basis, it is estimated that implementation of the TST technology to de-ice Air Canada aircraft at the Ottawa International Airport will eliminate the use of 139,105 liters of glycol and save 205,542 liters of jet fuel providing direct savings of over \$2 million, and eliminate over 230 hours of aircraft time on the ground (between push back from the gate and take off) reducing passenger delays and missed flights, crew time, and engine time and maintenance.
- Market rollout of this technology is expected to reduce annual GHG emissions by 16 kt CO₂e/yr in Canada and by 36.4 kt CO₂e/yr in the rest of the world by 2020.

Market Impact:

- The company has ceased operations, therefore, there are no market impacts to report.

ARISE Technologies Corp.

Round 8-2005B

Sector:

Power Generation

Project Delivery Completion:

June 2011

Market Impact Report Due:

June 2013

Total Project Value:

\$19,631,211

SDTC Funding:

\$6,439,037

Leveraged Funding:

\$13,192,174

Consortium Members:

ARISE Technologies Corp.

University of Toronto

University of Waterloo

Environmental Benefits

(primary Benefit Bolded)

Climate Change

Clean Air

Project Title:

Silicon Feedstock Pilot Plant Project

Project Description:

ARISE Technologies Corp. developed and demonstrated a new approach to refining high purity solar grade silicon feedstock for photovoltaic (PV) applications. A major constraint in the PV value chain has been the unpredictable supply of silicon. The ARISE approach uses a new technique to produce high purity silicon feedstock that can be used to produce crystalline silicon ingots for solar cells in a simplified, cost effective, and less energy intensive manner. The approach allows for the recovery and reuse of waste silicon. The silicon produced exceeds the specifications of high-efficiency solar PV cell manufacturers.

Objectives:

- Design and build a custom pilot plant facility to manufacture commercial scale silicon rods at a production cost of less than \$26/kg.
- Design and build a mini pilot reactor furnace that minimizes energy consumption.
- Produce solar grade silicon rods >30 cm long for silicon ingot production.
- Produce PV quality polysilicon at a cost sufficiently below established conventional alternatives, to justify scale-up to production at >1,000 t /year rates.

Results:

- Successfully demonstrated the energy and cost efficiency of the process as well as the high quality of the final silicon product.
- Produced mono-crystalline wafers used to make PV test cells with efficiencies up to 17%.
- Produced 7N+ material with regards to metallic impurities, with low carbon and oxygen and resistivity >2 Ohm-cm.
- Achieved comparable deposition rates of 0.5 mm/hr to the conventional Siemens process with their simplified refining process.
- Achieved competitive production costs at a much smaller annual volume than the traditional Siemens process.

Project Impacts:

- For every tonne of ARISE solar grade silicon deployed in operational solar panels, GHG emissions will be reduced by 9.2 t CO₂e in Canada and 23 t CO₂e in the rest of the world.

Path to Market:

- Sunlogics Power Fund Management Inc. (a wholly owned subsidiary of Salamon Group Inc.) completed the court approved acquisition of the assets of ARISE. The company intends to use partnering agreements for the ARISE technology for its own silicon manufacturing needs when appropriate, significantly lowering the manufacturing cost of silicon solar modules and increasing profitability of its solar power projects.
- ARISE Technology has the ability to produce solar grade silicon at less than \$26/kg as compared to silicon produced by the Siemens process at \$54/kg.
- The technology has demonstrated the ability to support a 5,000 t/year facility for two thirds the capital cost of a Siemens plant with the same silicon production capacity.
- The ARISE technology is expected to refine silicon on a 500 to 5,000 t/year scale opening the opportunity to license their technology or enter into joint venture partnerships.
- In Ontario, GHG emission reductions resulting from the forecasted market rollout have the potential to reach 207 kt CO₂e/year by 2020 (pre-acquisition forecast).

Market Impact:

- Following the court approved acquisition of ARISE Technologies Corp by Sunlogics Power Fund Management Inc. (a wholly owned subsidiary of Salamon Group Inc.) there is no market impact to report.

RER Hydro Ltd. (formerly RSW-RER Ltd.)

Round 15-2009A

Sector:

Power Generation

Project Delivery Completion:

April 2011

Market Impact Report Due:

April 2013

Total Project Value:

\$19,782,725

SDTC Funding:

\$2,760,000

Leveraged Funding:

\$17,022,725

Consortium Members:

RER Hydro Ltd.

ABB Inc

Environmental Benefits

(primary benefit bolded)

Climate Change

Clean Air

Project Title:

Hydro Kinetic Energy Recovery Turbine (TREK)

Project Description:

RER Hydro Ltd. developed and demonstrated a modular, shrouded, self-anchoring highly robust hydrokinetic turbine. The TREK expects to deliver renewable base load electricity at a lower cost than other renewable energy options and potentially current large hydro power projects. The technology can also be used to provide dispatchable and remote electricity currently being produced by diesel. A resource assessment conducted by RER Hydro indicated a potential for over 25 GW of clean electricity generation capacity from the TREK technology across Canada, with at least a further 1,000 GW of TREK capacity internationally. During the project one 250 kW (name plate capacity) TREK turbine was successfully installed and operated in the St. Lawrence River, near the Old Port of Montreal, delivering continuous power to the grid.

Objectives:

- Fully develop and test the TREK river turbine technology to ensure that it meets industry requirements in terms of durability, cost, performance and grid connection capability with minimal environmental impact.
- Validate the gravity base structure for deployment on the river bed and confirm the robustness of the entire energy conversion system.

Results:

- RER Hydro successfully developed and deployed a 250 kW turbine which under test conditions achieved 340 kW at 4.5 m/s, and which has been continuously delivering power to the grid since its installation in August 2010.
- Demonstrated net overall mechanical-to-electrical conversion efficiency greater than 95%.
- Operated the RER turbine successfully in water flow velocities between 1.5 and 3.25 m/s.
- Confirmed minimal environmental impact, in particular relating to fish populations.
- Validated equivalent of nearly 6.5 years of successful operation under accelerated fatigue and thermal cycling testing on in-house test benches, confirming a 10 year maintenance free life.
- Demonstrated the feasibility to economically produce clean base load electricity at par with all other renewable energy production options.

Project Impacts:

- During the project period GHG emissions were reduced by 9 t CO₂e.
- Each 250 kW hydrokinetic turbine is expected to reduce GHG emissions by 162 t CO₂e/yr in Canada and by 415 t CO₂e/yr in the rest of the world.

Path to Market:

- In most jurisdictions, RER Hydro is able to economically produce base load power at a lower cost than new clean power production.
- RER Hydro is currently developing a 20 unit integrated turbine farm demonstration project to validate multi-unit operations prior to full commercialization (SDTC Project 2011A-1978).
- RER Hydro has entered into an agreement with Northland Power Inc. to develop hydrokinetic power generation projects in North America.

Market Impact:

- RER Hydro is currently undertaking a second project with SDTC where RER Hydro Ltd. (formerly RER-RSW Ltd.), in partnership with Boeing Canada, are working to develop, implement and test a TREK LEAN+ manufacturing operation to confirm the design for manufacturability of the TREK and validate the manufacturing model for commercial deployment. With this objective in mind, by the end of the second project, RER Hydro will be positioned to transition to manufacturing for commercialization.

Prairie Pulp and Paper

Round 6 - 2004B

Sector:

Forestry, Wood Products and Pulp & Paper Products

Project Delivery Completion:

March 2011

Market Impact Report Due:

March 2013

Total Project Value:

\$3,521,525

SDTC Funding:

\$1,237,290

Leveraged Funding:

\$2,284,235

Consortium Members:

Prairie Pulp and Paper Inc.
Unisource Canada Inc.

Project Title:

Tree-Free Agricultural Fibre Paper Mill

Official Project Description:

Prairie Pulp & Paper Inc. (PPP) demonstrated production of high quality paper products, including computer printer, facsimile and photocopy paper using 100 percent agricultural residues such as flax stock. Employing an innovative agricultural fibre pulping process, this technology reuses otherwise discarded (and often openly burned) agricultural residues, which will generate profit-from-waste for Manitoba farmers, and offset the environmental impacts (energy, deforestation and chemical solvents) associated with producing paper from trees.

Objectives:

- Develop and demonstrate a tree-free process as an effective method of producing consumer grade paper with reduced environmental impacts.
- Determine whether office-use paper can be produced from a non-wood pulp consisting primarily of bleached flax straw and bleached wheat straw.
- Produce 200,000 sheets of paper to meet current industry specifications and performance standards for photocopy, lasergraphic, and inkjet copy applications.
- Determine if the quality of paper is acceptable and the product is cost effective enough to successfully compete in the large commodity paper market.

Project Results:

- Demonstrated the ability to manufacture high quality paper from non-tree sources by producing a 3,500 sheet batch print quality paper meeting current industry specifications and performance standards for photocopy, lasergraphic, and inkjet copy from 95% wheat and 5% flax.
- Due to a contaminated batch of chemicals, industry specifications and performance standards for photocopy, lasergraphic, and inkjet paper could not be met during the run of 200,000 sheets.
- Successfully distributed the 200,000 sheet run to Ecojot who used the paper to make notebooks with a natural look and feel, marketing them throughout North America.

Environmental Impacts:

- During the project period, GHG emissions were reduced by 2.2 t CO₂e.
- Globally, the Prairie Pulp & Paper technology is expected to reduce GHG emissions by 2.5 t CO₂e/t of tree-free paper displacing traditional paper.

Path to Market:

- Prairie Pulp & Paper is planning to construct a full-scale 200,000 t/year tree-free paper plant, employing up to 500 people in rural Manitoba, and providing an income to farmers for their crop residue, replacing current costs to burn stubble.
- The paper mill is expected to provide the Manitoba farm community with total benefits in excess of \$75 million/year while opening up a high value market for agricultural residues for commercial paper production.
- Prairie Pulp & Paper has an agreement with Unisource for paper distribution to big box customers and Business to Business accounts nationwide.
- Market rollout of this technology is expected to reduce annual GHG emissions by 1 Mt CO₂e/yr in Canada.

Market Impact:

- PPP is selling their product through Staples in Canada and the US, as well as Unisource in Canada. They are also working on securing business to business customers in the U.S.

EcoSmart Foundation

Round 7-2005A

Sector:

Energy Utilization

Project Delivery Completion:

January 2011

Market Impact Report Due:

January 2013

Total Project Value:

\$3,072,014

SDTC Funding:

\$1,499,142

Leveraged Funding:

\$1,572,872

Consortium Members:

EcoSmart Foundation Inc.
Lafarge Canada Inc.
Holcim (US) Cement
Busby, Perkins + Will Architects
Levelton Consultants Ltd.
Windmill Development
Group Ltd.
Halcrow Yolles
C&CS Atlantic Inc.
University of Calgary
AMEC Earth & Environmental
Read Jones Christoffersen Ltd
Graham Group Ltd.
University of Toronto
Canadian Steel Producers
Association
Natural Resources Canada
- CANMET
Greater Vancouver
Regional District
Public Works and Government
Services Canada
EBA Engineering
Consultants Ltd.
BCIT
Groupe SEM (SIMCO
Technologies Inc.)
Lehigh North West Cement Ltd.
Environment Canada

Environmental Benefits

(primary benefit bolded)

Climate Change

Clean Air

Project Title:

Supplementary Cementing Materials (SCM) Optimization System

Project Description:

EcoSmart Foundation Inc. successfully demonstrated a Supplementary Cementing Materials Optimization System (SOS) that allows developers, architects, engineers, contractors and material suppliers to optimize the use of supplementary cementing materials (SCMs) by simulating the effects of varying the multitude of parameters that interplay on construction projects. By determining optimal SCM levels and tradeoffs, the system enables users to reduce GHG emissions and construction costs, and lower the environmental footprint by directly reducing the amount of Portland cement required for construction projects.

Objectives:

- Develop a web-based computer software application that provides on-line expert guidance for the optimum selection of SCMs to be used in concrete. Typical examples of SCMs include natural pozzolans (like volcanic ash), fly ash, ground granulated blast furnace slag, rice husk ash, and silica fume.
- Reduce GHG emissions through reduction in cement usage.
- Facilitate rapid uptake in SCM use in the construction industry.

Results:

- Demonstrated a successful integrated decision-support system that allows developers, architects, engineers, suppliers and builders to simulate the effects of varying the type and level of supplementary cementing materials (SCM) on a construction project.
- Interactively determined the optimum make-up and quantities of SCM.
- Produced query tools for various concrete applications.
- Developed a reference database populated with scientific and technical knowledge including mixture characteristics, environmental data, codes and standards, material costs, and experience.
- Successfully completed numerous consortium partner member SCM tests, validating the efficacy of the technology to enable GHG emission reductions.

Project Impacts:

- For every tonne of cement displaced using the EcoSmart software, GHG emissions will be reduced by 0.8 t CO₂e.

Path to Market:

- The SOS technology is currently commercially available.
- EcoSmart and their consortium partners, continue to augment the database content, expanding their ability to deliver the SOS technology to the construction industry in Canada and internationally.
- EcoSmart has been successful in penetrating the Chinese market where the technology is positioned to enable significant GHG emission reductions.
- The SOS technology has the potential to enable the reduction of GHG emissions by 578 kt CO₂e/year in Canada and 290 Mt CO₂e/year in the rest of the world by 2020, based on construction industry adoption projections.

Market Impact:

- Upon completion of the SOS technology development, ownership, management and marketing of the software was provided to SIMCO as part of their contribution to the project. SIMCO was best positioned to do the marketing and implementation. EcoSmart as a non-for profit would have had much less impact.
- The SOS System has been rebranded and is included within SIMCO's STADIUM® software portfolio - the name of the system is now STADIUM® ECO. In addition, the SOS system is currently integrated within SIMCO's service offering and solutions under the title of "Sustainability Engineering".
- The program has been integrated in SIMCO services and as part of their STADIUM® program. As such, there are no specific costs associated to the SOS system and it is not SIMCO's intention to differentiate from the overall cost of the STADIUM® software. There are currently no plans to increase the cost of the STADIUM® software licences with the addition of the SOS system, making it an essentially free addition for current STADIUM® users.

Section 5: SD Tech Fund™ - Approved Project Funding Summary

Active Projects

*Project is contracted

CC = climate change, CA = clean air, CW = clean water, CS = clean soil

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government and Academia Funding	% of Total Eligible Project Costs	Total Eligible Project Costs	Environmental Benefits (Primary Benefits Bolded)
Round 23-2013A								
Carbon Engineering Ltd.	\$3,000,000	37.6%	\$3,437,500	43.0%	\$1,550,000	19.4%	\$7,987,500	CC
Cleeve Technology Inc.	\$710,000	32.3%	\$1,490,000	67.7%	\$0	0.0%	\$2,200,000	CW CS
Electro Kinetic Solutions Inc.	\$2,116,140	33.3%	\$2,232,279	35.2%	\$2,000,000	31.5%	\$6,348,419	CC CA CS
Green Power Labs Inc.	\$1,650,000	29.6%	\$1,506,609	27.0%	\$2,415,420	43.3%	\$5,572,029	CC CA
GreenMantra Technologies	\$2,007,450	33.0%	\$4,075,731	67.0%	\$0	0.0%	\$6,083,181	CC CA CS
Inventys Thermal Technologies Inc.	\$3,100,000	32.7%	\$6,392,458	67.3%	\$0	0.0%	\$9,492,458	CC
Morgan Solar Inc.	\$2,067,778	33.0%	\$2,348,216	37.5%	\$1,850,000	29.5%	\$6,265,994	CC CA
Nemaska Lithium Inc.	\$12,870,000	32.1%	\$17,225,000	43.0%	\$10,000,000	24.9%	\$40,095,000	CC CA CS
Orbite Aluminae Inc.	\$4,500,000	32.0%	\$8,562,000	61.0%	\$981,310	7.0%	\$14,043,310	CC CW CS
Pure Technologies Ltd.	\$1,000,000	33.2%	\$1,400,000	46.4%	\$615,000	20.4%	\$3,015,000	CC
Saltworks Technologies Inc.	\$2,500,000	33.3%	\$5,000,000	66.7%	\$0	0.0%	\$7,500,000	CC CA CW
Segetis, Inc	\$15,000,000	18.1%	\$54,000,000	65.1%	\$14,000,000	16.9%	\$83,000,000	CC CA
Sysgaz Inc.	\$2,205,539	33.0%	\$3,134,233	46.9%	\$1,348,673	20.2%	\$6,688,445	CC CA
Verolube Inc	\$3,994,060	32.9%	\$8,149,440	67.1%	\$0	0.0%	\$12,143,500	CC CA
ZincNyx Energy Solutions	\$2,900,000	32.1%	\$5,855,684	64.9%	\$270,000	3.0%	\$9,025,684	CC CA
Round 22-2012B								
ExtremeOcean Innovation Inc.	\$550,000	28.8%	\$532,043	27.9%	\$825,000	43.3%	\$1,907,043	CC CA
Hifi Engineering Inc.	\$2,000,000	33.3%	\$4,000,000	66.7%	\$0	0.0%	\$6,000,000	CW CS
Luxmux Technology Corp.	\$980,350	33.0%	\$1,354,000	45.6%	\$636,400	21.4%	\$2,970,750	CC CA CW
Macrotek Inc.	\$1,953,700	33.3%	\$3,909,591	66.7%	\$0	0.0%	\$5,863,291	CC CA CS
Polymer Research Technologies	\$1,116,826	33.3%	\$2,233,652	66.7%	\$0	0.0%	\$3,350,478	CC CS
Soiless Technology Inc.	\$2,500,000	33.0%	\$2,125,668	28.1%	\$2,950,000	38.9%	\$7,575,668	CC CA CW CS
Solantra Semiconductor Corp.	\$3,800,000	32.8%	\$7,800,500	67.2%	\$0	0.0%	\$11,600,500	CC CA
Steeper Energy Canada Ltd.	\$3,000,000	28.7%	\$2,953,000	28.3%	\$4,500,000	43.0%	\$10,453,000	CC CW
Switchable Solutions Inc.	\$5,200,000	33.3%	\$5,400,000	34.6%	\$5,000,000	32.1%	\$15,600,000	CC CW CS
Ubiquity Solar Inc.	\$3,122,445	31.2%	\$4,303,492	43.1%	\$2,566,169	25.7%	\$9,992,106	CC CA
Unit Electrical Engineering Ltd	\$344,217	33.0%	\$683,444	65.5%	\$15,421	1.5%	\$1,043,082	CC
Vive Crop Protection Inc.*	\$3,723,504	33.7%	\$7,326,695	66.3%	\$0	0.0%	\$11,050,199	CW CS

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government and Academia Funding	% of Total Eligible Project Costs	Total Eligible Project Costs	Environmental Benefits (Primary Benefits Bolded)
Round 21-2012A								
Airex Industries Inc.	\$2,700,000	34.1%	\$2,510,000	31.7%	\$2,700,000	34.1%	\$7,910,000	CC CA
Borealis Geopower Inc.	\$2,379,962	33.3%	\$4,759,925	66.7%	\$0	0.0%	\$7,139,887	CC CA
Canada Lithium Corp.	\$6,500,000	32.0%	\$13,803,893	68.0%	\$0	0.0%	\$20,303,893	CC CA CW
Diacarbon Energy Inc.*	\$1,050,000	13.5%	\$6,727,260	86.5%	\$0	0.0%	\$7,777,260	CC CA
Nichromet Extraction Inc.*	\$5,000,000	25.3%	\$14,768,788	74.7%	\$0	0.0%	\$19,768,788	CW CS
NuWave Research Inc.*	\$2,030,000	36.9%	\$2,418,094	44.0%	\$1,050,000	19.1%	\$5,498,094	CC CA CS
Polystyvert Inc.*	\$480,000	48.0%	\$370,114	37.0%	\$150,000	15.0%	\$1,000,114	CC CS
R.I.I. North America Inc.*	\$2,496,508	30.0%	\$4,990,079	60.0%	\$835,105	10.0%	\$8,321,692	CC CA CW
Venmar CES Inc.*	\$1,990,000	30.0%	\$4,497,748	67.9%	\$138,000	2.1%	\$6,625,748	CC CA CS
Western Hydrogen Ltd.*	\$1,480,000	32.9%	\$3,012,123	67.1%	\$0	0.0%	\$4,492,123	CC CA CW
Yava Technologies Inc.	\$399,123	33.3%	\$798,245	66.7%	\$0	0.0%	\$1,197,368	CC CA CS
Round 20-2011B								
Agri-Neo Inc.*	\$1,500,000	33.3%	\$1,625,966	36.1%	\$1,375,000	30.5%	\$4,500,966	CW CS
Atlantis Operations (Canada) Ltd.	\$5,000,000	32.3%	\$10,500,000	67.7%	\$0	0.0%	\$15,500,000	CC CA
Développement Effenco Inc.*	\$1,780,188	30.5%	\$3,399,276	58.3%	\$650,000	11.2%	\$5,829,464	CC CA
Eocycle Technologies Inc.	\$5,969,600	33.0%	\$6,670,092	36.9%	\$5,450,000	30.1%	\$18,089,692	CC CA
GHGSat Inc.*	\$2,017,648	32.6%	\$2,026,193	32.7%	\$2,149,773	34.7%	\$6,193,614	CC CA
MEG Energy Corp.*	\$7,000,000	4.7%	\$120,637,763	81.7%	\$20,000,000	13.5%	\$147,637,763	CC CA
Minesense Technologies Ltd.*	\$4,435,794	33.0%	\$8,512,500	63.3%	\$493,506	3.7%	\$13,441,800	CC CA CS
New Flyer Industries ULC Canada*	\$3,400,000	34.1%	\$4,537,418	45.5%	\$2,042,986	20.5%	\$9,980,404	CC CA
Power Measurement Ltd.	\$1,702,882	33.3%	\$2,955,764	57.9%	\$450,000	8.8%	\$5,108,646	CC CA
semiosBIO Technologies Inc.*	\$3,040,000	36.1%	\$5,265,304	62.5%	\$120,000	1.4%	\$8,425,304	CW CS
Solar Ship Inc.*	\$2,180,000	36.1%	\$3,865,647	63.9%	\$0	0.0%	\$6,045,647	CC CA
Verve Energy Solutions Inc.	\$3,017,400	25.0%	\$6,034,800	50.0%	\$3,017,400	25.0%	\$12,069,600	CC CA CW
Whale Shark Environmental Technologies Ltd.*	\$629,266	49.0%	\$454,951	35.4%	\$200,000	15.6%	\$1,284,217	CC CA CW

Section 5 – SD Tech Fund™ Approved Project Funding Summary

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government and Academia Funding	% of Total Eligible Project Costs	Total Eligible Project Costs	Environmental Benefits (Primary Benefits Bolded)
Round 19-2011A								
Accelerated Systems Inc.*	\$1,400,000	35.0%	\$2,600,624	65.0%	\$0	0.0%	\$4,000,624	CC CA
CVTCORP Transmission*	\$1,027,887	31.1%	\$1,362,559	41.2%	\$913,237	27.6%	\$3,303,683	CC CA
EcoSynthetix Corp.*	\$2,100,000	32.9%	\$2,031,875	31.8%	\$2,250,000	35.3%	\$6,381,875	CC CA CW
Hydrostor Inc.*	\$2,171,011	37.0%	\$1,901,057	32.4%	\$1,795,529	30.6%	\$5,867,597	CC CA
Pure Technologies Ltd.*	\$1,000,000	33.3%	\$1,710,000	57.0%	\$290,000	9.7%	\$3,000,000	CC CW
RSW Renewable Energy Research Ltd.*	\$6,000,000	26.6%	\$3,000,000	13.3%	\$13,541,526	60.1%	\$22,541,526	CC
TISEC Inc.	\$440,000	47.2%	\$392,760	42.1%	\$100,000	10.7%	\$932,760	CC CA CW CS
Vision Ecoproducts Ltd.*	\$3,252,342	30.8%	\$7,303,675	69.2%	\$0	0.0%	\$10,556,017	CC CA
Round 18-2010B								
BioAmber Sarnia Inc.*	\$14,513,650	23.2%	\$42,563,106	68.1%	\$5,400,000	8.6%	\$62,476,756	CC
CarbonCure Technologies Inc.*	\$1,192,000	36.3%	\$1,400,143	42.7%	\$690,140	21.0%	\$3,282,283	CC CA CW
CoolEdge Lighting Ltd.*	\$4,180,000	34.3%	\$5,994,015	49.2%	\$2,005,000	16.5%	\$12,179,015	CC CA CW CS
Logistik Unicorp*	\$1,012,828	36.2%	\$1,124,396	40.2%	\$660,419	23.6%	\$2,797,643	CC CA
Namgis First Nation	\$4,150,000	36.3%	\$5,091,360	44.6%	\$2,182,000	19.1%	\$11,423,360	CW
Northex Environment Inc.	\$1,552,354	38.8%	\$1,588,720	39.7%	\$857,175	21.4%	\$3,998,249	CW CS
Nova Green Inc.	\$1,838,152	32.0%	\$3,860,183	67.2%	\$50,000	0.9%	\$5,748,335	CC
N-Solv Corp.*	\$10,000,000	37.0%	\$10,644,748	39.4%	\$6,400,000	23.7%	\$27,044,748	CC CA CW
Paradigm Shift Technologies Inc.*	\$1,955,250	35.9%	\$3,494,106	64.1%	\$0	0.0%	\$5,449,356	CC CA
PAVAC Industries Inc.*	\$3,549,865	33.7%	\$6,976,755	66.3%	\$0	0.0%	\$10,526,620	CC CA
Shipstone Corp.*	\$2,513,498	46.0%	\$2,953,712	54.0%	\$0	0.0%	\$5,467,210	CC CA
Solantra Semiconductor Corp.*	\$2,049,234	28.8%	\$4,932,430	69.4%	\$125,000	1.8%	\$7,106,664	CC CA
TM4 Inc.*	\$3,135,371	20.4%	\$4,469,334	29.1%	\$7,772,936	50.5%	\$15,377,641	CC CA
Round 17-2010A								
Ballard Power Systems Inc.*	\$7,304,367	34.4%	\$13,934,617	65.6%	\$0	0.0%	\$21,238,984	CC CA
Corvus Energy Ltd.*	\$582,467	33.0%	\$1,182,585	67.0%	\$0	0.0%	\$1,765,052	CC CA
CRB Innovations Inc.*	\$5,362,500	35.2%	\$6,882,884	45.1%	\$3,000,000	19.7%	\$15,245,384	CC CA
eCAMION Inc.*	\$5,435,749	33.3%	\$10,871,499	66.7%	\$0	0.0%	\$16,307,248	CC CA

CC = climate change, CA = clean air, CW = clean water, CS = clean soil

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government and Academia Funding	% of Total Eligible Project Costs	Total Eligible Project Costs	Environmental Benefits (Primary Benefits Bolded)
Echologics Engineering Inc.*	\$1,051,926	32.7%	\$1,794,785	55.8%	\$370,679	11.5%	\$3,217,390	CC CW CS
FibraCast*	\$1,947,736	33.0%	\$2,662,860	45.1%	\$1,291,633	21.9%	\$5,902,229	CC CW
Mining Technologies International Inc.*	\$613,261	33.2%	\$1,236,648	66.8%	\$0	0.0%	\$1,849,909	CC CA
NIMTech Inc.*	\$726,174	45.6%	\$691,661	43.4%	\$175,562	11.0%	\$1,593,397	CC CW
S2G Biochemicals Inc.*	\$2,386,952	33.9%	\$3,385,305	48.0%	\$1,277,105	18.1%	\$7,049,362	CC CW
Temporal Power Ltd.*	\$4,123,000	34.3%	\$7,900,000	65.7%	\$0	0.0%	\$12,023,000	CC CA
Tyne Engineering Inc.*	\$1,534,097	31.1%	\$2,190,344	44.4%	\$1,210,508	24.5%	\$4,934,949	CC CA CW CS
Westport Power Inc.*	\$2,302,834	12.3%	\$16,450,810	87.7%	\$0	0.0%	\$18,753,644	CC CA
Round 16-2009B								
6574262 Canada Inc. (ICUS)*	\$320,248	36.0%	\$569,332	64.0%	\$0	0.0%	\$889,580	CC CW CS
Available Energy Corp.*	\$1,020,000	42.9%	\$1,132,662	47.7%	\$222,595	9.4%	\$2,375,257	CC CA CW
EnerMotion Inc.*	\$1,100,000	39.9%	\$1,653,598	60.1%	\$0	0.0%	\$2,753,598	CC CA
Etailm Inc.*	\$2,936,530	39.0%	\$2,264,838	30.1%	\$2,330,031	30.9%	\$7,531,399	CC CA CW CS
Gestion TechnoCap Inc., Space-Watts Division*	\$840,000	31.2%	\$1,136,140	42.2%	\$718,168	26.7%	\$2,694,308	CC CA
InvoDane Engineering Ltd.*	\$2,467,125	28.0%	\$6,329,998	72.0%	\$0	0.0%	\$8,797,123	CC
MARA Renewables Corp.*	\$6,764,146	33.3%	\$13,528,293	66.7%	\$0	0.0%	\$20,292,439	CC CA CW CS
MPT Mustard Products & Technologies Inc.*	\$2,217,949	31.0%	\$4,853,152	67.7%	\$94,957	1.3%	\$7,166,058	CC CA CW CS
Phostech Lithium Inc.*	\$4,700,508	32.7%	\$9,676,487	67.3%	\$0	0.0%	\$14,376,995	CC CA
Quadrogen Power Systems Inc.*	\$2,910,145	39.1%	\$3,477,831	46.7%	\$1,053,245	14.2%	\$7,441,221	CC CA
Spartan Bioscience Inc.*	\$1,896,774	29.8%	\$4,058,028	63.9%	\$400,000	6.3%	\$6,354,802	CC CW CS
Tenova Goodfellow Inc.*	\$1,522,513	24.7%	\$4,646,389	75.3%	\$0	0.0%	\$6,168,902	CC
Round 15-2009A								
Agrisoma Biosciences Inc.*	\$2,500,000	30.5%	\$5,563,883	67.8%	\$145,000	1.8%	\$8,208,883	CC CA CW CS
Ballard Power Systems Inc.*	\$6,905,887	21.3%	\$457,597	1.4%	\$25,028,105	77.3%	\$32,391,589	CC CA
Electroaya Corp.*	\$8,224,171	31.2%	\$14,147,976	53.8%	\$3,948,026	15.0%	\$26,320,173	CC CA
Exro Technologies Inc.*	\$881,235	22.0%	\$3,119,807	78.0%	\$0	0.0%	\$4,001,042	CC CA
HTEC Hydrogen Technology & Energy Corp.*	\$5,001,074	36.0%	\$8,675,852	62.5%	\$214,947	1.6%	\$13,891,873	CC CA

Section 5 – SD Tech Fund™ Approved Project Funding Summary

CC = climate change, CA = clean air, CW = clean water, CS = clean soil

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government and Academia Funding	% of Total Eligible Project Costs	Total Eligible Project Costs	Environmental Benefits (Primary Benefits Bolded)
Morgan Solar Inc.*	\$2,351,580	25.3%	\$6,327,711	68.0%	\$620,181	6.7%	\$9,299,472	CC CA
NutraCanada*	\$1,900,000	19.2%	\$5,970,622	60.2%	\$2,050,000	20.7%	\$9,920,622	CC CW CS
Pulse Energy Inc.*	\$2,556,801	29.9%	\$4,033,246	47.2%	\$1,962,868	22.9%	\$8,552,915	CC CA
PV Labs Inc.*	\$965,253	32.7%	\$1,987,791	67.3%	\$0	0.0%	\$2,953,044	CC CW CS
SBI BioEnergy Inc.*	\$1,875,495	30.4%	\$3,123,737	50.7%	\$1,162,339	18.9%	\$6,161,571	CC CA CW CS
Terragon Environmental Technologies Inc.*	\$2,874,000	40.0%	\$3,219,057	44.9%	\$1,084,258	15.1%	\$7,177,315	CW CS
Round 14-2008B								
Deane and Co. Inc.*	\$595,000	39.7%	\$904,904	60.3%	\$0	0.0%	\$1,499,904	CW CS
Durapar Technologies Inc.*	\$2,829,000	44.6%	\$2,789,675	43.9%	\$729,999	11.5%	\$6,348,674	CA CW CS
Eco-Ag Initiatives Inc.*	\$1,948,000	33.6%	\$3,455,615	59.7%	\$388,000	6.7%	\$5,791,615	CC CA CW CS
Imtex Membranes Corp.*	\$2,753,948	31.5%	\$5,909,930	67.7%	\$71,500	0.8%	\$8,735,378	CC CA
Lignol Innovations Ltd.*	\$6,870,561	33.3%	\$8,515,609	41.3%	\$5,246,146	25.4%	\$20,632,316	CC CA CS
MEG Energy Corp.*	\$4,270,000	31.6%	\$7,846,606	58.1%	\$1,400,000	10.4%	\$13,516,606	CC
Saltworks Technologies Inc.*	\$2,612,638	32.4%	\$3,595,900	44.6%	\$1,855,484	23.0%	\$8,064,022	CC CW
Soane Energy (Canada) Inc.*	\$3,032,434	26.5%	\$8,410,714	73.5%	\$0	0.0%	\$11,443,149	CC CW
Statoil Hydro Canada Ltd.*	\$6,000,000	15.5%	\$32,791,337	84.5%	\$0	0.0%	\$38,791,337	CC CW
SunSelect Produce (Delta) Inc.*	\$1,672,425	29.8%	\$3,409,622	60.8%	\$526,959	9.4%	\$5,609,006	CC CA
Sunwell Technologies Inc.*	\$4,135,447	39.0%	\$6,426,437	60.6%	\$41,827	0.4%	\$10,603,711	CC CA
Xogen Technologies Inc.*	\$1,974,104	46.7%	\$2,152,973	50.9%	\$100,000	2.4%	\$4,227,077	CW CS
Round 13-2008A								
Altera Energy Inc.*	\$1,254,317	14.1%	\$4,872,803	54.8%	\$2,763,972	31.1%	\$8,891,092	CC CA CW
dPoint Technologies Inc.*	\$1,531,394	42.7%	\$2,051,568	57.3%	\$0	0.0%	\$3,582,961	CC CA
General Fusion Inc.*	\$13,897,455	21.9%	\$49,590,730	78.0%	\$60,000	0.1%	\$63,548,185	CC CA
GreenField Ethanol Inc.*	\$3,649,019	30.3%	\$4,393,261	36.5%	\$4,000,686	33.2%	\$12,042,966	CC CA CW CS
Innoventé Inc.*	\$2,730,526	37.9%	\$2,094,131	29.1%	\$2,375,386	33.0%	\$7,200,042	CC CW CS
Nexterra Energy Corp.*	\$5,518,777	31.4%	\$8,215,067	46.8%	\$3,830,000	21.8%	\$17,563,845	CC CA

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Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government and Academia Funding	% of Total Eligible Project Costs	Total Eligible Project Costs	Environmental Benefits (Primary Benefits Bolded)
Round 12-2007B								
Atlantec BioEnergy Corp.*	\$1,833,482	34.7%	\$3,447,577	65.3%	\$0	0.0%	\$5,281,059	CC CA CW CS
BioDiesel Reactor Technologies Inc.*	\$3,448,000	43.6%	\$1,739,263	22.0%	\$2,720,769	34.4%	\$7,908,032	CC CA CW CS
GaN Systems Inc.*	\$1,500,000	29.1%	\$3,656,209	70.9%	\$0	0.0%	\$5,156,209	CC CA
Himark bioGas Inc.*	\$3,331,976	32.3%	\$6,971,081	67.7%	\$0	0.0%	\$10,303,057	CC CW CS
Marine Exhaust Solutions Inc.*	\$1,320,804	37.4%	\$2,206,991	62.6%	\$0	0.0%	\$3,527,795	CC CA
Petroleum Technology Research Centre (Aquistore)*	\$5,000,000	18.2%	\$13,473,745	49.0%	\$9,000,000	32.8%	\$27,473,745	CC
Verdant Power Canada ULC*	\$1,150,000	30.5%	\$1,020,696	27.1%	\$1,597,715	42.4%	\$3,768,411	CC CA
Western Hydrogen Ltd.*	\$4,162,653	32.2%	\$6,755,346	67.8%	\$0	0.0%	\$12,917,999	CC CA
Round 11-2007A								
bstNRG.com Inc. (formerly Vidir Biomass Inc)*	\$1,651,169	45.0%	\$2,018,095	55.0%	\$0	0.0%	\$3,669,264	CC CA CS
Corporation HET - Horizon Environnement Technologies*	\$1,509,807	27.6%	\$3,468,447	63.3%	\$500,000	9.1%	\$5,478,254	CC CW CS
Fuseforward International Inc.*	\$400,000	26.2%	\$679,343	44.6%	\$444,578	29.2%	\$1,523,921	CA CW CS
Round 8-2005B								
New Energy Corp. Inc.*	\$2,000,000	31.4%	\$1,633,467	25.6%	\$2,741,058	43.0%	\$6,374,525	CC CA
Wind Smart Inc.*	\$1,082,738	40.1%	\$980,258	36.3%	\$639,618		\$2,702,614	CC CA
Total	\$418,891,993	27.0%	\$904,584,161	58.4%	\$226,772,029	14.6%	\$1,550,248,183	

Completed Projects

Note: Amounts are based on actual disbursements at project completion

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Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government and Academia Funding	% of Total Eligible Project Costs	Total Eligible Project Costs	Environmental Benefits (Primary Benefits Bolded)
Round 17-2010A								
SWITCH Materials Inc.	\$2,363,621	29.4%	\$4,089,113	50.8%	\$1,594,045	19.8%	\$8,046,780	CC CA
Woodland Biofuels Inc.	\$4,275,000	33.1%	\$4,625,000	35.9%	\$4,000,000	31.0%	\$12,900,000	CC CW CS
Round 16-2009B								
InvenTys Thermal Technologies Inc.	\$1,598,001	40.8%	\$1,957,239	50.0%	\$359,707	9.2%	\$3,914,947	CC
Lakeshore EMPC Two L.P.	\$1,037,669	41.6%	\$1,456,728	58.4%	\$0	0.0%	\$2,494,397	CC CW CS
Round 15-2009A								
Automotive Fuel Cell Cooperation Corp.	\$11,558,274	22.2%	\$40,438,931	77.8%	\$0	0.0%	\$51,997,205	CC CA
Entropex Ltd.	\$6,330,000	25.3%	\$14,521,709	58.0%	\$4,172,680	16.7%	\$25,024,389	CC CA CW CS
RER Hydro Ltd.	\$2,760,000	14.0%	\$14,322,725	72.4%	\$2,700,000	13.6%	\$19,782,725	CC CA
Round 14-2008B								
Alcoa Ltd.	\$170,958	28.5%	\$428,887	71.5%	\$0	0.0%	\$599,845	CC CA CW CS
Canadian Pallet Council	\$1,058,755	43.6%	\$1,369,582	56.4%	\$0	0.0%	\$2,428,338	CC CA
Titanium Corp. Inc.	\$6,292,635	29.2%	\$13,437,837	62.4%	\$1,795,970	8.3%	\$21,526,442	CC CW CS
Round 13-2008A								
A.U.G. Signals Ltd.	\$2,020,661	34.3%	\$3,872,993	65.7%	\$0	0.0%	\$5,893,655	CC CA CW
EcoSynthetix Corp.	\$1,679,331	33.0%	\$1,612,596	31.7%	\$1,796,955	35.3%	\$5,088,882	CC CA
Integran Technologies, Inc.	\$1,481,328	33.2%	\$2,236,794	50.1%	\$746,400	16.7%	\$4,464,522	CC CA CW
Paragon Soil and Environmental Consulting Inc.	\$231,151	43.8%	\$296,592	56.2%	\$0	0.0%	\$527,743	CC CA CW CS
SunCentral Inc.	\$2,345,208	33.3%	\$2,331,107	33.1%	\$2,359,523	33.5%	\$7,035,838	CC CA
Vive Crop Protection Inc.	\$3,954,706	35.8%	\$2,911,011	26.4%	\$4,172,886	37.8%	\$11,038,603	CC CA CW CS
Round 12-2007B								
Integran Technologies Inc. (Morph)	\$5,616,635	32.7%	\$11,411,024	66.4%	\$170,000	1.0%	\$17,197,659	CC CA
Pathogen Detection Systems Inc.	\$2,671,627	31.1%	\$3,388,328	39.4%	\$2,539,045	29.5%	\$8,599,000	CW
Pure Technologies Ltd.	\$795,000	31.7%	\$1,133,335	45.2%	\$580,000	23.1%	\$2,508,335	CC CA CW

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Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government and Academia Funding	% of Total Eligible Project Costs	Total Eligible Project Costs	Environmental Benefits (Primary Benefits Bolded)
Round 11-2007A								
Développement Effenco Inc.	\$1,074,955	28.3%	\$2,093,388	55.1%	\$633,456	16.7%	\$3,801,799	CC CA
General Electric Canada (Locomotive)	\$3,903,394	33.3%	\$7,818,509	66.7%	\$0	0.0%	\$11,721,903	CC CA
MSR Innovations Inc.	\$680,839	46.2%	\$456,929	31.0%	\$335,629	22.8%	\$1,473,397	CC CA
St-Jean Photochemicals	\$1,673,424	32.9%	\$1,590,522	31.3%	\$1,825,520	35.9%	\$5,089,466	CC CA CS
TM4 inc. Auto	\$3,818,787	30.9%	\$7,272,737	58.8%	\$1,286,000	10.4%	\$12,377,524	CC CA
Round 10-2006B								
Advanced Lithium Power Inc	\$1,400,000	25.3%	\$3,734,876	67.5%	\$400,000	7.2%	\$5,534,876	CC CA
Calisolar Inc.	\$4,074,505	26.0%	\$10,022,872	64.0%	\$1,559,432	10.0%	\$15,656,809	CC CA
CVTCORP Transmission Inc.	\$2,131,950	27.9%	\$3,892,915	50.9%	\$1,625,000	21.2%	\$7,649,865	CC CA
Fifth Light Technology Ltd.	\$3,911,300	30.5%	\$7,225,340	56.3%	\$1,700,000	13.2%	\$12,836,640	CC CA
Middle Bay Sustainable Aquaculture Institute	\$3,645,291	30.5%	\$8,300,337	69.5%	\$0	0.0%	\$11,945,628	CW CS
SIREM ULC	\$318,304	32.8%	\$652,135	67.2%	\$0	0.0%	\$970,439	CW CS
Terragon Environmental Technologies Inc.	\$1,592,500	38.9%	\$1,787,094	43.6%	\$718,190	17.5%	\$4,097,783	CC CA CW CS
TM4 Inc. Wind	\$622,542	18.6%	\$1,824,460	54.5%	\$900,000	26.9%	\$3,347,002	CC CA
Turbo Trac Systems ULC Inc.	\$188,934	4.5%	\$4,012,688	95.5%	\$0	0.0%	\$4,201,622	CC CA
Round 9-2006A								
Dynamic Systems Inc.	\$738,531	36.4%	\$1,289,550	63.6%	\$0	0.0%	\$2,028,081	CC CA
Enerkem Technologies Inc.	\$2,660,476	15.5%	\$14,486,785	84.5%	\$0	0.0%	\$17,147,261	CC CA
General Electric Canada (Microgrid)	\$2,485,395	33.3%	\$783,047	10.5%	\$4,187,741	56.2%	\$7,456,183	CC CA CW CS
Milligan Bio-Tech Inc.	\$7,004,493	24.9%	\$21,117,230	75.0%	\$19,892	0.1%	\$28,141,614	CC CA
Round 8-2005B								
ARISE Technologies Corp.	\$6,439,037	32.8%	\$13,192,174	67.2%	\$0	0.0%	\$19,631,211	CC CA
BESTECH (Boudreau-Espley-Pitre Corp.)	\$1,448,000	32.2%	\$3,046,502	67.8%	\$0	0.0%	\$4,494,502	CC CA
Chinook Mobile Heating and De-icing Inc.	\$3,063,766	41.5%	\$3,078,016	41.7%	\$1,236,500	16.8%	\$7,378,282	CC CW CS
EcoVu Analytics Inc.	\$1,035,555	32.7%	\$1,957,513	61.8%	\$172,647	5.5%	\$3,165,715	CW

Section 5 – SD Tech Fund™ Approved Project Funding Summary

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								CC	CA
Hydrogenics Corp.	\$2,248,493	28.4%	\$5,668,736	71.6%	\$0	0.0%	\$7,917,229	CC	CA
Maritime Innovation (IMAR)	\$979,800	38.5%	\$1,128,392	44.4%	\$435,565	17.1%	\$2,543,757		CW
Nutriloc Ingredients Corp.	\$847,319	35.2%	\$822,782	34.2%	\$734,393	30.5%	\$2,404,493	CC	CA
Ostara Nutrient Recovery Technologies Inc.	\$375,760	21.1%	\$682,959	38.4%	\$718,910	40.4%	\$1,777,628	CC	CA
Power Measurement Ltd.	\$2,960,871	32.5%	\$5,893,795	64.7%	\$250,000	2.7%	\$9,104,666	CC	CA
Pure Technologies Ltd.	\$2,200,000	32.2%	\$3,858,424	56.4%	\$782,138	11.4%	\$6,840,562	CC	CA
Tantalus Systems Corp.	\$2,981,310	29.5%	\$7,121,213	70.5%	\$0	0.0%	\$10,102,523	CC	CA
Unicell Ltd.	\$756,155	21.3%	\$1,960,040	55.2%	\$833,828	23.5%	\$3,550,024	CC	CA
Round 7-2005A									
EcoSmart Foundation Inc.	\$1,499,142	48.8%	\$1,453,483	47.3%	\$119,389	3.9%	\$3,072,014	CC	CA
N-Solv Corp.	\$4,155,843	26.3%	\$11,650,516	73.7%	\$0	0.0%	\$15,806,359	CC	CA
Petroleum Technology Research Centre (JIVE)	\$3,168,990	33.0%	\$5,854,010	61.0%	\$580,000	6.0%	\$9,603,000	CC	CA
Plasco Trail Road Inc.	\$9,494,466	13.3%	\$53,077,190	74.6%	\$8,572,538	12.0%	\$71,144,194	CC	CA
Power Diagnostic Technologies Ltd.	\$1,191,107	34.1%	\$2,296,365	65.8%	\$1,910	0.1%	\$3,489,382	CC	CA
Vaperma Inc.	\$5,049,958	33.3%	\$8,169,915	53.9%	\$1,930,000	12.7%	\$15,149,873	CC	CA
Round 6-2004B									
Angstrom Power Inc.	\$169,752	13.4%	\$978,519	77.5%	\$115,000	9.1%	\$1,263,271	CC	CA
Clean Current Power Systems Inc.	\$1,582,000	33.0%	\$3,213,500	67.0%	\$0	0.0%	\$4,795,500	CC	CA
Electrowaya Corp.	\$1,859,530	33.0%	\$3,775,410	67.0%	\$0	0.0%	\$5,634,940	CC	CA
Leapfrog Lighting Inc. (formerly Group IV Semiconductor Inc.)	\$3,724,663	31.0%	\$3,805,821	31.7%	\$4,486,251	37.3%	\$12,016,735	CC	CA
Prairie Pulp and Paper Inc.	\$1,237,290	35.1%	\$1,989,235	56.5%	\$295,000	8.4%	\$3,521,525	CC	CA
Pratt & Whitney Canada Corp.	\$5,624,850	32.0%	\$11,940,725	68.0%	\$0	0.0%	\$17,565,575	CC	CA
Science Applications International Corp. (SAIC Canada)	\$1,009,589	20.8%	\$246,143	5.1%	\$3,590,824	74.1%	\$4,846,556	CC	CA
Sunarc of Canada Inc.	\$545,357	30.0%	\$730,538	40.2%	\$543,327	29.9%	\$1,819,222	CC	CA
University of British Columbia	\$2,408,702	33.0%	\$3,776,993	51.7%	\$1,113,403	15.3%	\$7,299,098	CC	CA

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Round 5-2004A								
Atlantic Hydrogen Inc.	\$2,096,948	30.4%	\$3,220,266	46.7%	\$1,576,334	22.9%	\$6,893,548	CC CA
Atlantic Packaging Products Ltd.	\$2,268,430	28.5%	\$5,690,974	71.5%	\$0	0.0%	\$7,959,404	CC CA CS
Great Northern Power Corp.	\$2,063,403	28.4%	\$5,077,138	69.9%	\$125,000	1.7%	\$7,265,541	CC CA
M.A. Turbo/Engine Ltd.	\$152,844	46.0%	\$179,760	54.0%	\$0	0.0%	\$332,604	CA
Tenova Goodfellow Inc.	\$3,322,441	30.0%	\$6,517,230	58.8%	\$1,237,878	11.2%	\$11,077,549	CC CA
Round 4-2003B								
BIOX Canada Ltd.	\$5,000,000	11.3%	\$35,423,977	79.7%	\$4,000,000	9.0%	\$44,423,977	CC CA
Fifth Light Technology Ltd.	\$3,036,000	33.0%	\$3,914,000	42.5%	\$2,250,000	24.5%	\$9,200,000	CC
Lignol Innovations Ltd.	\$6,240,816	30.7%	\$9,369,986	46.1%	\$4,715,120	23.2%	\$20,325,922	CC CA
Nanox Inc.	\$1,774,548	40.0%	\$1,249,748	28.2%	\$1,413,500	31.9%	\$4,437,796	CA
Sacré-Davey Innovations	\$5,727,711	32.4%	\$6,208,370	35.1%	\$5,745,629	32.5%	\$17,681,710	CC CA
Synodon Inc.	\$1,056,790	23.1%	\$2,748,328	60.1%	\$767,752	16.8%	\$4,572,871	CC
Whitefox Technologies Canada Ltd.	\$2,608,545	37.4%	\$4,374,554	62.6%	\$0	0.0%	\$6,983,099	CC CA
Round 3-2003A								
Blue-Zone Technologies Ltd.	\$2,700,000	32.4%	\$3,851,540	46.2%	\$1,783,981	21.4%	\$8,335,521	CC
Hydrogenics Corp.	\$1,350,419	44.0%	\$1,327,716	43.3%	\$391,000	12.7%	\$3,069,135	CA
Paradigm Environmental Technologies Inc.	\$250,000	20.7%	\$653,804	54.1%	\$305,000	25.2%	\$1,208,804	CC CA CW
PlugPower Canada Inc.	\$2,000,000	22.2%	\$6,026,000	66.8%	\$1,000,000	11.1%	\$9,026,000	CA
Quantium Technologies Inc.	\$1,450,000	14.7%	\$5,487,819	55.7%	\$2,907,000	29.5%	\$9,844,819	CC CA
Saskatchewan Power Corp. (SaskPower)	\$2,682,900	24.1%	\$8,446,708	75.8%	\$20,000	0.2%	\$11,149,608	CA
Round 2-2002B								
Enerkem Technologies Inc.	\$720,573	32.0%	\$1,316,047	58.4%	\$216,798	9.6%	\$2,253,418	CC CA CS
Ensyn Technologies Inc.	\$2,000,000	22.5%	\$3,295,871	37.0%	\$3,600,000	40.5%	\$8,895,871	CC CA
Highmark Renewables Inc.	\$1,000,000	14.2%	\$3,801,570	53.9%	\$2,254,675	32.0%	\$7,056,245	CC CA CW CS
Mikro-Tek Inc.	\$500,400	14.4%	\$2,982,950	85.6%	\$0	0.0%	\$3,483,350	CC
Radiant Technologies Inc.	\$1,000,000	39.6%	\$1,278,144	50.6%	\$250,000	9.9%	\$2,528,144	CC CA
University of New Brunswick	\$257,826	35.5%	\$325,228	44.8%	\$142,457	19.6%	\$725,511	CC CA

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West Lome Bio-Oil Co-Generation Ltd. Partnership	\$5,000,000	40.9%	\$7,215,947	59.1%	\$0	0.0%	\$12,215,947	CC CA
ZENON Environmental Inc.	\$1,760,000	33.0%	\$3,574,000	67.0%	\$0	0.0%	\$5,334,000	CC CA CW
Round 1-2002A								
Bio-Terre Systems Inc.	\$864,375	37.5%	\$800,974	34.7%	\$639,651	27.8%	\$2,305,000	CC CA CW CS
Carmanah Technologies Inc.	\$466,167	22.9%	\$1,568,895	77.1%	\$0	0.0%	\$2,035,062	CC CA
CO ₂ Solution Inc.	\$1,000,000	17.0%	\$1,614,557	27.5%	\$3,267,001	55.5%	\$5,881,558	CC
Westport Innovations Inc.	\$1,000,000	32.1%	\$1,565,376	50.2%	\$550,000	17.7%	\$3,115,376	CA
Total	\$229,574,621	26.6%	\$524,679,331	60.9%	\$107,848,470	12.5%	\$862,102,423	

Early Termination Projects

Note: Amounts are based on actual disbursement prior to termination

CC = climate change, CA = clean air, CW = clean water, CS = clean soil

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government and Academia Funding	% of Total Eligible Project Costs	Total Eligible Project Costs	Environmental Benefits (Primary Benefits Bolded)
Round 16-2009B								
3XR Inc.	\$593,000	33.2%	\$570,044	31.9%	\$624,524	34.9%	\$1,787,568	CW
Round 14-2008B								
Thermal Frost Inc.	\$639,659	62.0%	\$391,618	38.0%	\$0	0.0%	\$1,031,277	CA
Round 13-2008A								
Performance Plants Inc.	\$651,400	33.5%	\$1,293,077	66.5%	\$0	0.0%	\$1,944,476	CW CS
Round 12-2007B								
Aboriginal Cogeneration Corp.	\$1,369,354	26.5%	\$3,795,178	73.5%	\$0	0.0%	\$5,164,532	CA CW CS
Alstom Hydro Canada Inc.	\$1,396,351	17.0%	\$6,834,948	83.0%	\$0	0.0%	\$8,231,299	CC CA
Lancaster Wind Systems Inc.	\$566,194	34.6%	\$1,071,006	65.4%	\$0	0.0%	\$1,637,200	CC CA
SIXtron Advanced Materials	\$1,331,823	20.6%	\$5,132,979	79.4%	\$0	0.0%	\$6,464,802	CC CA
Round 11-2007A								
Biothermica Technologies Inc.	\$80,713	36.0%	\$79,031	35.2%	\$64,458	28.7%	\$224,202	CC
Enviro Tower Inc.	\$300,000	32.0%	\$637,500	68.0%	\$0	0.0%	\$937,500	CW
Ferrinov Inc.	\$1,083,366	19.9%	\$3,809,358	70.1%	\$542,251	10.0%	\$5,434,975	CC CA CS
Round 10-2006B								
Biogenie S.R.D.C. Inc.	\$230,137	30.7%	\$518,367	69.3%	\$0	0.0%	\$748,504	CC CA CS
Early Warning Inc.	\$2,068,041	33.7%	\$2,984,119	48.6%	\$1,085,296	17.7%	\$6,137,455	CA CW CS
HTC Hydrogen Technologies Corp.	\$635,414	45.3%	\$767,751	54.7%	\$0	0.0%	\$1,403,165	CC CA
Nova Scotia Power Inc.	\$4,650,000	39.7%	\$7,054,996	60.3%	\$0	0.0%	\$11,704,996	CC CA CW
NxtGen Emission Controls Inc.	\$2,265,194	23.8%	\$7,244,761	76.2%	\$0	0.0%	\$9,509,955	CC CA
Round 9-2006A								
Biothermica Technologies Inc.	\$200,487	33.4%	\$400,000	66.6%	\$0	0.0%	\$600,487	CC CA CS
Magenn Power Inc.	\$691,119	12.7%	\$4,205,462	77.4%	\$539,000	9.9%	\$5,435,581	CC CA
MiniMiner Oilsands Inc.	\$3,435,372	27.2%	\$8,500,573	67.3%	\$700,000	5.5%	\$12,635,945	CC CA CS
Zenon Membrane Solutions	\$665,540	37.5%	\$1,111,128	62.5%	\$0	0.0%	\$1,776,668	CC CW
Round 8-2005B								
Bio Vision Technology Inc.	\$749,848	28.7%	\$1,183,727	45.4%	\$675,000	25.9%	\$2,608,575	CC CA
Cerestech Inc.	\$751,627	32.3%	\$1,575,391	67.7%	\$0	0.0%	\$2,327,017	CW
Mechtronix Systems Inc.	\$1,933,987	32.5%	\$1,783,422	30.0%	\$2,233,320	37.5%	\$5,950,729	CC CW CS

Section 5 – SD Tech Fund™ Approved Project Funding Summary

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government and Academia Funding	% of Total Eligible Project Costs	Total Eligible Project Costs	Environmental Benefits (Primary Benefits Bolded)
Round 7-2005A								
AirScience Technologies Inc.	\$417,661	30.4%	\$956,224	69.6%	\$0	0.0%	\$1,373,885	CC CA
Dépôt Rive-Nord Inc.	\$0	50.0%	\$0	50.0%	\$0	0.0%	\$0	CC CA
Envirogain Inc.	\$957,623	43.3%	\$1,252,582	56.7%	\$0	0.0%	\$2,210,205	CC CA CW CS
Maratek Environmental	\$915,205	28.1%	\$1,240,905	38.1%	\$1,100,000	33.8%	\$3,256,110	CC CA CW
Netisix Technologies Corp.	\$471,199	40.3%	\$698,007	59.7%	\$0	0.0%	\$1,169,206	CC CA
Nexterra Energy Corp.	\$1,159,518	33.0%	\$1,052,280	29.9%	\$1,301,893	37.1%	\$3,513,692	CC CA
Round 5-2004A								
Alternative Green Energy Systems Inc.	\$517,041	29.3%	\$1,244,887	70.7%	\$0	0.0%	\$1,761,928	CC CA CS
Xantrex Technology Inc.	\$1,213,614	33.0%	\$2,464,004	67.0%	\$0	0.0%	\$3,677,618	CC CA
Round 4-2003B								
DeCloet Greenhouse Manufacturing Ltd.	\$176,434	31.7%	\$325,387	58.4%	\$55,000	9.9%	\$556,821	CC
NxtPhase T&D Corp.	\$887,598	24.6%	\$2,727,097	75.4%	\$0	0.0%	\$3,614,695	CC
Round 3-2003A								
RailPower Technologies Corp.	\$584,079	35.7%	\$800,521	49.0%	\$250,000	15.3%	\$1,634,600	CA
Round 2-2002B								
IBC Technologies Inc.	\$183,150	20.9%	\$677,580	77.2%	\$16,420	1.9%	\$877,150	CC CA
Round 1-2002A								
Mabarex Inc.	\$225,000	40.9%	\$300,000	54.5%	\$25,000	4.5%	\$550,000	CC CA
NOVA Chemicals Corp.	\$320,000	33.5%	\$636,575	66.5%	\$0	0.0%	\$956,575	CC CA
Suncor Energy Inc.	\$889,132	25.0%	\$1,800,000	50.6%	\$866,537	24.4%	\$3,555,669	CC
Total	\$35,205,880	28.8%	\$77,120,485	63.0%	\$10,078,699	8.2%	\$122,405,062	

Section 6: SD Tech Fund™ - Project Classification

SDTC Approved Funding in Hydrogen Economy, Clean Fossil Fuels, Clean Water and Clean Soil Projects
(as of December 31, 2013)

*Amounts are based on approved project value – contracting to be finalized.

Hydrogen Economy Projects			
Round	Lead Organization	Total Eligible Project Costs	SDTC Approved Funding
Round 21 - 2012A	Western Hydrogen Ltd.	\$ 4,492,123	\$ 1,480,000
Round 17 - 2010A	Ballard Power Systems Inc.	\$ 21,238,984	\$ 7,304,367
Round 16 - 2009B	Available Energy Corp.	\$ 2,375,257	\$ 1,020,000
	Quadrogen Power Systems, Inc.	\$ 7,441,221	\$ 2,910,145
Round 15 - 2009A	Automotive Fuel Cell Cooperation Corp.	\$ 51,997,205	\$ 11,558,274
	Ballard Power Systems	\$ 32,391,589	\$ 6,905,887
	HTEC Hydrogen Technology & Energy Corp.	\$ 13,891,873	\$ 5,001,074
Round 12 - 2007B	Western Hydrogen Ltd.	\$ 12,917,999	\$ 4,162,653
Round 10 - 2006B	HTC Hydrogen Technologies Corp.	\$ 1,511,718	\$ 585,414
Round 8 - 2005B	Hydrogenics Corp.	\$ 7,917,229	\$ 2,248,493
Round 7 - 2005A	AirScience Technologies Inc.	\$ 1,373,885	\$ 417,661
Round 6 - 2004B	Angstrom Power Inc.	\$ 1,263,271	\$ 169,752
Round 5 - 2004A	Atlantic Hydrogen Inc.	\$ 6,893,548	\$ 2,096,948
Round 4 - 2003B	Sacre-Davey Innovations Inc.	\$ 17,681,710	\$ 5,727,711
Round 3 - 2003A	Hydrogenics Corp.	\$ 3,069,135	\$ 1,350,419
	Plug Power Canada Inc.	\$ 9,026,000	\$ 2,000,000
16 Projects		\$ 195,482,747	\$ 54,938,798

Clean Fossil Fuel Projects			
Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 23 - 2013A	Saltworks Technologies Inc.*	\$7,500,000	\$2,500,000
	Electro Kinetic Solutions Inc.*	\$6,348,419	\$2,116,140
	Carbon Engineering Ltd.*	\$7,987,500	\$3,000,000
	Inventys Thermal Technologies Inc.*	\$9,492,458	\$3,100,000
Round 22 - 2012B	Luxmux Technology Corp.*	\$2,970,750	\$980,350
	Switchable Solutions Inc.*	\$15,600,000	\$5,200,000
	Hifi Engineering Inc.*	\$6,000,000	\$2,000,000
Round 21 - 2012A	Western Hydrogen Ltd.	\$ 4,492,123	\$ 1,480,000
	R.I.I. North America Inc.	\$ 8,321,692	\$ 2,496,508

Clean Fossil Fuel Projects			
Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 20 - 2011B	MEG Energy Corp	\$147,637,763	\$ 7,000,000
	Verve Energy Solutions Inc.*	\$ 12,069,600	\$ 3,017,400
Round 18 - 2010B	N-Solv Corp.	\$ 27,044,748	\$ 10,000,000
Round 16 - 2009B	Inventys Thermal Technologies Inc.	\$ 3,914,947	\$ 1,598,001
	InvoDane Engineering Ltd.	\$ 8,797,123	\$ 2,467,125
Round 14 - 2008B	MEG Energy Corp.	\$ 13,516,606	\$ 4,270,000
	Soane Energy (Canada) Inc.	\$ 11,443,149	\$ 3,032,434
	Statoil Hydro Canada Ltd.	\$ 38,791,337	\$ 6,000,000
	Titanium Corp. Inc.	\$ 21,526,442	\$ 6,292,635
Round 13 - 2008A	Paragon Soil and Environmental Consulting Inc.	\$ 527,743	\$ 231,151
Round 12 - 2007B	Petroleum Technology Research Centre	\$ 27,473,745	\$ 5,000,000
	Western Hydrogen Ltd.	\$ 12,917,999	\$ 4,162,653
Round 10 - 2006B	Turbo Trac Systems ULC Inc.	\$ 4,201,622	\$ 188,934
Round 9 - 2006A	MinMiner Oilsands Inc.	\$ 12,635,945	\$ 3,435,372
Round 7 - 2005A	N-Solv Corp.	\$ 15,806,359	\$ 4,155,843
	Petroleum Technology Research Centre	\$ 9,603,000	\$ 3,168,990
	Power Diagnostic Technologies Ltd.	\$ 3,489,382	\$ 1,191,107
Round 4 - 2003B	Synodon Inc.	\$ 4,572,871	\$ 1,056,790
Round 1 - 2002A	Suncor Energy Inc.	\$ 3,555,669	\$ 889,132
	CO ₂ Solution Inc.	\$ 5,881,558	\$ 1,000,000
29 Projects		\$ 454,120,550	\$ 91,030,565

Clean Water / Clean Soil Projects			
Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 23 - 2013A	Orbite Aluminae Inc.*	\$14,043,310	\$4,500,000
	Cleeve Technology Inc.*	\$2,200,000	\$710,000
	Saltworks Technologies Inc.*	\$7,500,000	\$2,500,000
	Electro Kinetic Solutions Inc.*	\$6,348,419	\$2,116,140
	GreenMantra Technologies*	\$6,083,181	\$2,007,450
Round 22 - 2012B	Hifi Engineering Inc.*	\$6,000,000	\$2,000,000
	Vive Crop Protection, Inc.	\$11,050,199	\$3,723,504
	Soilless Technology Inc.*	\$7,575,668	\$2,500,000
	Polymer Research Technologies*	\$3,350,478	\$1,116,826

Clean Water / Clean Soil Projects			
Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 21 - 2012A	Nichromet Extraction Inc.	\$ 19,768,788	\$5,000,000
	Polystyvert Inc.	\$ 1,000,114	\$480,000
	Yava Technologies Inc.*	\$1,197,368	\$399,123
Round 20 - 2011B	semiosBIO Technologies Inc.	\$ 8,425,304	\$3,040,000
	Whale Shark Environmental Technologies Ltd.	\$ 1,284,217	\$ 629,266
	Minesense Technologies Ltd.	\$ 13,441,800	\$4,435,794
	Agri-Neo Inc.	\$4,500,966	\$1,500,000
	Verve Energy Solutions Inc.*	\$12,069,600	\$3,017,400
Round 19 - 2011A	Pure Technologies Ltd.	\$3,000,000	\$1,000,000
	TISEC Inc.*	\$932,760	\$440,000
Round 18 - 2010B	Namgis First Nation	\$ 11,423,360	\$4,150,000
	Northex Environnement Inc.*	\$3,998,249	\$1,552,354
Round 17 - 2010A	Echologics Engineering Inc.	\$ 3,217,390	\$1,051,926
	FibraCast	\$ 5,902,229	\$1,947,736
	Tyne Engineering Inc.	\$4,934,949	\$1,534,097
Round 16 - 2009B	3XR Inc.	\$1,787,568	\$593,000
	6574262 Canada Inc. (ICUS)	\$889,580	\$320,248
	Available Energy Corp.	\$2,375,257	\$1,020,000
	Lakeshore EMPC Two L.P.	\$ 2,494,397	\$1,037,669
	MPT Mustard Products & Technologies Inc.	\$ 7,166,058	\$2,217,949
	Spartan Bioscience	\$6,354,802	\$1,896,774
Round 15 – 2009A	Agrisoma Biosciences Inc.	\$8,208,883	\$2,500,000
	Entropex (a partnership of Unitec Inc. and 629728 Ontario Ltd.)	\$ 25,024,389	\$6,330,000
	PV Labs Inc.	\$2,953,044	\$965,253
	NutraCanada	\$9,920,622	\$1,900,000
	SBI BioEnergy Inc.	\$6,161,571	\$1,875,495
	Terragon Environmental Technologies Inc.	\$7,177,315	\$2,874,000
Round 14 – 2008B	Deane Ltee	\$1,499,904	\$595,000
	Duopar Technologies Inc.	\$ 6,348,674	\$2,829,000
	Eco-Ag Initiatives	\$5,791,615	\$1,948,000
	Statoil Hydro Canada Ltd.	\$38,791,337	\$6,000,000
	Saltworks Technologies Inc.	\$8,064,022	\$2,612,638
	Soane Energy (Canada) Inc.	\$11,443,149	\$3,032,434
	Titanium Corp. Inc.	\$21,526,442	\$6,292,635
	Xogen Technologies Inc.	\$4,227,077	\$1,974,104
Round 13 – 2008A	AUG Signals Ltd.	\$5,893,655	\$2,020,661
	Innoventé Inc.	\$7,200,042	\$2,730,526
	Paragon Soil and Environmental Consulting Inc.	\$527,743	\$231,151
	Performance Plants Inc.	\$ 1,944,476	\$ 651,400
	Vive Crop Protection Inc.	\$ 11,038,603	\$3,954,706

Clean Water / Clean Soil Projects			
Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 12 – 2007B	Aboriginal Cogeneration Corp.	\$ 5,164,532	\$1,369,354
	Atlantec BioEnergy Corp.	\$5,281,059	\$1,833,482
	BioDiesel Reactor Technologies Inc.	\$7,908,032	\$3,448,000
	Himark bioGas Inc.	\$10,303,057	\$3,331,976
	Pathogen Detection Systems Inc.	\$ 8,599,000	\$2,671,627
	Pure Technologies Ltd.	\$2,508,335	\$795,000
Round 11 – 2007A	Fuseforward International Inc.	\$1,523,921	\$400,000
	Corp. HET - Horizon Environnement Technologies	\$5,478,254	\$1,509,807
	Envirotower Inc.	\$937,500	\$300,000
	Ferrinov Inc.	\$5,434,975	\$1,083,366
Round 10 - 2006B	Biogénie S.R.D.C. Inc.	\$748,504	\$230,137
	Early Warning Inc.	\$6,137,455	\$2,068,041
	Middle Bay Sustainable Aquaculture Institute	\$ 11,945,628	\$3,645,291
	SiREM Canada	\$970,439	\$318,304
	Terragon Environmental Technologies Inc.	\$4,097,783	\$1,592,500
Round 9 - 2006A	MinMiner Oilsands Inc.	\$12,635,945	\$3,435,372
	Zenon Membrane Solutions	\$1,776,668	\$665,540
Round 8 - 2005B	Chinook Mobile Heating & Deicing Corp.	\$7,378,282	\$3,063,766
	EcoVu Analytics	\$3,165,715	\$1,035,555
	Maritime Innovation (IMAR)	\$2,543,757	\$979,800
	Ostara Nutrient Recovery Technologies Inc.	\$1,777,628	\$375,760
	Pure Technologies Ltd.	\$6,840,562	\$2,200,000
71 Projects		\$477,215,605	\$146,106,937

Classification Allocation % to Climate Change and Clean Air

Of the SD Tech Fund™'s total value, 80 percent is to be allocated to projects that have an environmental benefit that relates primarily to climate change and clean air. The remaining 20 percent is to be allocated to clean soil and clean water projects.

To date, SDTC has approved \$538M in funding to projects that address climate change and clean air where:

- 89% has been allocated to projects that address primarily climate change; and 11% has been allocated to projects that address primarily clean air.

Since 2006, SDTC has allocated \$146M to projects that primarily address water and soil environmental benefits.

While projects are classified in a primary benefit category, multiple benefits are encouraged. The attribution to a specific primary environmental impact needs to be interpreted in conjunction with the following. Of the total portfolio of two hundred and sixty nine (269) funded projects:

- 89% of SDTC-funded projects have climate change benefits;
- 75% have clean air benefits;
- 44% have soil or water benefits; and,
- 89% of all SDTC projects have more than one environmental benefit.

SDTC Portfolio Environmental Benefits

The unique contribution of clean technologies is derived from the coupling of environmental benefits with productivity and economic growth. SDTC portfolio projects achieve positive economic and environmental impacts relating to clean air, clean water, reduced waste, soil protection, and climate change mitigation. In fact, 89% of SDTC projects have multiple environmental benefits. As the portfolio matures, SDTC is developing better ways to quantify and report these benefits in order to clearly and accurately capture the full environmental value derived from SDTC investments in clean technologies.

SDTC is required to report on environmental benefits relating to clean air, clean water, clean soil, and climate change. Due to the advancement and growth in climate change mitigation initiatives, sophisticated methods for greenhouse gas (GHG) emissions quantification and reporting have been established. SDTC applies these internationally accepted methods to estimate climate change mitigation benefits of its investments based on forecasted and actual market roll-out. This approach has been very successful, however, similar estimating methodologies based on a common unit (e.g. CO₂e) are not currently available or in common use for clean air, clean water, or soil projects – either domestically or internationally. Consequently, SDTC has developed approaches for quantifying and reporting the benefits of clean air, clean water, and soil projects that accurately capture the value of SDTC investments in these areas.

CLIMATE CHANGE

The best conservative estimate of total annual GHG emissions reduction by 2015, attributable to the 269 projects in the SDTC portfolio, is 9 Megatonnes of CO₂e, from a projected range of between 6 and 12 Megatonnes. The trend in GHG emissions reductions from SDTC portfolio projects is for considerable growth with a best conservative estimate for the year 2020 of between 40 and 97 Megatonnes of CO₂e. These figures include adjustments to account for the uncertainty of projections by applying a discounting factor to individual projects.¹

Of the 98 SDTC funded projects completed prior to 2014, a total of 65 have climate change mitigation benefits and have reported actual annual GHG emissions reductions of approximately 2.8 Megatonnes CO₂e.

CLEAN AIR

A total of 87 projects in the SDTC portfolio have been identified as providing clean air benefits. Assessing the clean air benefits of projects is usually more complex than evaluating GHG reductions, as proponents quantify and report on potential benefits from total Criteria Air Contaminants (CAC) emissions reductions in tonnes_(CAC)/year.

The actual environmental and human health impacts of CACs depend on population density and air shed concentrations in areas where they are emitted. For example, the impact of smog precursors emitted in a high-population-density urban area is more significant than if they were emitted in a low-population-density area. Therefore, presenting the net CAC emissions reductions in “tonnes of X” reduced alone does not give the full picture of the actual benefits from SDTC clean air projects.

Using input and validation from external experts, SDTC has established a defensible and conservative methodology for presenting the benefits from clean air projects in a way that takes into account regional and industrial variations in impacts.

The majority of the costs associated with CAC emissions are related to health impacts on human populations in high smog index airsheds. The identified methodology translates project level CAC emissions reductions to health benefits associated with reduced smog in sensitive Canadian airsheds. This methodology is based on Environment Canada’s regional airshed concentration measurements and modeling and Health Canada’s model (AQBAT), which allows a determination of the risk of health incidents in populations based on airshed concentration exposure. A similar approach is used by the US EPA to quantify the benefits of certain clean air policies. Using industry sub-sector specific parameters, the change in

¹ Emission reduction projections are inherently forward-looking statements. They involve risks and uncertainties that could cause actual results to differ materially from those contemplated.

SDTC believes it has a reasonable basis for making such forward-looking statements by:

- requiring every applicant to estimate future GHG emissions reductions using a prescribed methodology based on accepted ISO and IPCC practices,
- reviewing the conservativeness of projected GHG emissions reductions reported by applicants and, as new information is reported, adjusting projections based on actual market penetration and project performance, and excluding or further discounting projects with high uncertainty, and
- applying a discount rate of between 35% and 99% to account for the technology GHG intensity performance and the likelihood to meet sales projections.

smog exposure risk that would result from CAC emissions reductions achieved through the deployment of SDTC clean air technologies can be estimated and translated to a change in likely health related cost impacts.

Based on the approach, SDTC has modeled the market roll-out impacts of the 87 completed projects and progressing projects in surface transportation and power generation applications. The results indicate that the avoided health impacts, or cost, for these SDTC projects would enable a discounted² avoided health related cost of over \$1.5 billion by 2025³. In progressing towards these results, these 87 projects are expected to lead to the following specific annual CAC emissions reductions within Canada by 2015.

**Total cumulative (discounted) projected environmental impacts
for the 87 Clean Air projects by 2015**

Contaminant	2015 (tonnes CAC emissions reduced per year)
PM	459
NO _x	3,293
SO _x	6,155 ⁴
VOCs	148 ⁵

SOIL / WATER

Impact quantification in terms of soil and water benefits depends on a wide range of factors which make the estimation of environmental benefits more complex than evaluating GHG or CAC emissions reductions. SDTC requests that proponents identify total water conservation, contaminant removal, waste reduction, and land conservation as part of their application. SDTC compiles and tracks these as potential water and soil benefits.

The actual environmental and human health benefits and value to society of water and soil related projects depend on considerations such as; the type of contaminant, environmental fate of pollutants, paths of exposure, location, existing use of land or watershed. Contaminated or degraded freshwater and soil resources represent a cost burden to the Canadian economy. Conversely, the availability and access to clean water and healthy, viable soil provide valuable ecological services to the Canadian economy that generally go undervalued. Simply presenting the net water conservation or contaminant removal from water or soil does not provide a clear and quantifiable representation of the actual benefits.

Working with external experts in this area, SDTC has developed methodologies to quantify and report the benefits from SDTC’s investments in water technologies over the past few years. This exercise identified an approach for estimating the avoided costs from the displaced environmental impacts.

Using these methodologies, SDTC has estimated the benefits of 30 funded clean water projects that are completed or in progress based on the avoided costs associated with water conservation in various application sectors (municipal, agricultural, manufacturing, and others) and reduced nitrogen and phosphorus loading in water systems. It is estimated that these projects will lead to an avoided water treatment or use cost of greater than \$128M⁶ by 2025. In progressing towards these benefits, the 30 water projects reviewed are expected to have the following benefits by 2015.

2 Consistent with other SDTC methodologies, these amounts have been discounted by up to 93.5% when market roll-out and environmental performance have not been validated. SDTC may use project-specific discount rates to assess the uncertainty of a specific investment.

3 The year 2025 is selected as a forecast year to capture the fact that these investments are in vehicle technologies (transport trucks, locomotives, etc.) and power generation and energy efficiency systems that would have operational lifetimes as high as 20 years.

4 2015 SO_x emissions reductions estimates are higher than previous estimates due to the successful roll-out of a number of projects that now report confirmed SO_x emissions reductions instead of discounted estimated reductions.

5 2015 VOC emissions reductions estimates are lower than previous estimates due to the adoption of a more conservative estimation model and the delayed roll-out of a number of key projects in this area.

6 The year 2025 is selected as a forecast year to capture the fact that these investments are in water treatment, leak detection systems, of industrial process facilities that would have operational lifetimes or enduring benefits in a typical range of 20 years. This value is discounted up to a maximum internal rate of 93.5%.

Total cumulative (discounted) projected environmental impacts for 30 Clean Water projects by 2015

Benefits	
Water Conservation (m ³)	77,464,000
Nitrogen Release Avoided (tonnes)	112
Phosphorus Release Avoided (tonnes)	304

SDTC has recently implemented methodologies for estimating the benefits of 24 clean soil projects that are completed or in progress. The clean soil benefits are based on the avoided costs associated with several parameters including; landfill tipping fees, soil treatment and remediation for contaminated soils, and the environmental effects of diverse pollutants present in soils. Loss of agricultural productivity is considered, but population health effects of pesticide application are currently excluded from the methodology pending approval of a reliable quantification metric. Valuing soil quality is difficult so a conservative estimate of parameters is used. It is estimated that these projects will lead to an avoided cost greater than \$155M⁷ by 2025.

Landfill avoidance is reported in terms of total tonnes of material and monetized value based on avoided landfill tipping fee costs (using a \$40/tonne tipping fee). Soil treatment avoidance includes diverse technologies and projects with wide-ranging applications. Benefits are reported as cost savings using the appropriate metric for each project, including; tailing pond size reduction for oil sands projects, rehabilitation of brownfield sites, treatment of halogenated soils, and other chemical treatments. Soil pollutant emissions reductions are also monetized based on parameters for managing key pollutants including: lead, cadmium, chromium, mercury, selenium, arsenic, copper, zinc, and dioxins.

Total cumulative (discounted) projected environmental impacts for 24 Clean Soil projects by 2015

Benefits	
Landfill Avoidance (tonnes)	22,870
Landfill Avoidance (\$CAN)	\$914,800
Soil Treatment Avoidance (\$CAN)	\$17,814,524
Soil Pollutant Emissions Reduction (\$CAN)	\$1,281,389
Mining Project Impacts (\$CAN)	\$4,459,000

⁷ The year 2025 is selected as a forecast year to capture the fact that these investments in waste minimization, polluted soil treatment alternatives, and reduction of pollutant loads to soil would have operational lifetimes or enduring benefits in a typical range of 20 years. This value is discounted up to a maximum internal rate of 93.5%.

Section 7: SD Tech Fund™ - Portfolio by Region

Lead Organization	Province	SDTC Funds	Total Eligible Project Costs
Atlantic Canada			
6574262 Canada Inc. (ICUS)	Newfoundland	\$320,248	\$889,580
Atlantec BioEnergy Corp.	Prince Edward Island	\$1,833,482	\$5,281,059
Atlantic Hydrogen Inc.	New Brunswick	\$2,096,948	\$6,893,548
Atlantis Operations (Canada) Ltd.	Nova Scotia	\$5,000,000	\$15,500,000
Bio Vision Technology Inc.	Nova Scotia	\$749,848	\$2,608,575
CarbonCure Technologies Inc.	Nova Scotia	\$1,192,000	\$3,282,283
ExtremeOcean Innovation Inc.	Newfoundland	\$550,000	\$1,907,043
Green Power Labs Inc.	Nova Scotia	\$1,650,000	\$5,572,029
MARA Renewables Corp.	Nova Scotia	\$6,764,146	\$20,292,439
Nova Scotia Power Inc.	Nova Scotia	\$4,650,000	\$11,704,996
University of New Brunswick	New Brunswick	\$257,826	\$725,511
Total		\$25,064,498	\$74,657,063
Quebec			
Agri-Neo Inc.	Quebec	\$1,500,000	\$4,500,966
Airex Industries Inc.	Quebec	\$2,700,000	\$7,910,000
AirScience Technologies Inc.	Quebec	\$417,661	\$1,373,885
Alcoa Ltd.	Quebec	\$170,958	\$599,845
Alstom Hydro Canada Inc.	Quebec	\$1,396,351	\$8,231,299
Alternative Green Energy Systems Inc.	Quebec	\$517,041	\$1,761,928
BioAmber Sarnia Inc.	Quebec	\$14,513,650	\$62,476,756
Biogénie S.R.D.C. Inc.	Quebec	\$230,137	\$748,504
Bio-Terre Systems Inc.	Quebec	\$864,375	\$2,305,000
Biothermica Technologies Inc.	Quebec	\$80,713	\$224,202
Biothermica Technologies Inc.	Quebec	\$200,487	\$600,487
Cerestech Inc.	Quebec	\$751,627	\$2,327,017
CO ₂ Solution inc.	Quebec	\$1,000,000	\$5,881,558
Corporation HET - Horizon Environnement Technologies	Quebec	\$1,509,807	\$5,478,254
CRB Innovations Inc.	Quebec	\$5,362,500	\$15,245,384
CVTCorp Transmission Inc.	Quebec	\$1,027,887	\$3,303,683
CVTCORP Transmission Inc.	Quebec	\$2,131,950	\$7,649,865

Lead Organization	Province	SDTC Funds	Total Eligible Project Costs
Quebec			
Deane and Co. Inc.	Quebec	\$595,000	\$1,499,904
Dépôt Rive-Nord Inc.	Quebec	\$0	\$0
Développement Effenco Inc.	Quebec	\$1,780,188	\$5,829,464
Développement Effenco Inc.	Quebec	\$1,074,955	\$3,801,799
Early Warning Inc.	Quebec	\$2,068,041	\$6,137,455
Enerkem Technologies Inc.	Quebec	\$2,660,476	\$17,147,261
Enerkem Technologies Inc.	Quebec	\$720,573	\$2,253,418
Envirogain Inc.	Quebec	\$957,623	\$2,210,205
Eocycle Technologies Inc.	Quebec	\$5,969,600	\$18,089,692
Ferrinov Inc.	Quebec	\$1,083,366	\$5,434,975
Gestion TechnoCap Inc., SpaceWatts Division	Quebec	\$840,000	\$2,694,308
GHGSat Inc.	Quebec	\$2,017,648	\$6,193,614
Innoventé Inc.	Quebec	\$2,730,526	\$7,200,042
Logistik Unicorp	Quebec	\$1,012,828	\$2,797,643
Mabarex Inc.	Quebec	\$225,000	\$550,000
Marine Exhaust Solutions Inc.	Quebec	\$1,320,804	\$3,527,795
Maritime Innovation (IMAR)	Quebec	\$979,800	\$2,543,757
Mechtronix Systems Inc.	Quebec	\$1,933,987	\$5,950,729
Nanox Inc.	Quebec	\$1,774,548	\$4,437,796
Nemaska Lithium Inc.	Quebec	\$12,870,000	\$40,095,000
Nichromet Extraction Inc.	Quebec	\$5,000,000	\$19,768,788
Northex Environnement Inc.	Quebec	\$1,552,354	\$3,998,249
NutraCanada	Quebec	\$1,900,000	\$9,920,622
Orbite Aluminae Inc.	Quebec	\$4,500,000	\$14,043,310
Phostech Lithium Inc.	Quebec	\$4,700,508	\$14,376,995
Polystyvert Inc.	Quebec	\$480,000	\$1,000,114
RER Hydro Ltd.	Quebec	\$2,760,000	\$19,782,725
RER Hydro Ltd.	Quebec	\$6,000,000	\$22,541,526
SIXtron Advanced Materials	Quebec	\$1,331,823	\$6,464,802
St-Jean Photochemicals	Quebec	\$1,673,424	\$5,089,466
Sunarc of Canada Inc.	Quebec	\$545,357	\$1,819,222
Sysgaz Inc.	Quebec	\$2,205,539	\$6,688,445
Terragon Environmental Technologies Inc.	Quebec	\$2,874,000	\$7,177,315

Section 7 – SD Tech Fund™ Portfolio by Region

Lead Organization	Province	SDTC Funds	Total Eligible Project Costs
Quebec			
Terragon Environmental Technologies Inc.	Quebec	\$1,592,500	\$4,097,783
TISEC Inc.	Quebec	\$440,000	\$932,760
TM4 Inc.	Quebec	\$3,135,371	\$15,377,641
TM4 Inc. (Auto)	Quebec	\$3,818,787	\$12,377,524
TM4 Inc. (Wind)	Quebec	\$622,542	\$3,347,002
Turbo Trac Systems ULC Inc.	Quebec	\$188,934	\$4,201,622
Vaperma Inc.	Quebec	\$5,049,958	\$15,149,873
Total		\$127,361,204	\$457,169,274
Ontario			
3XR Inc.	Ontario	\$593,000	\$1,787,568
A.U.G. Signals Ltd.	Ontario	\$2,020,661	\$5,893,655
Accelerated Systems Inc.	Ontario	\$1,400,000	\$4,000,624
Agrisoma Biosciences Inc.	Ontario	\$2,500,000	\$8,208,883
ARISE Technologies Corp.	Ontario	\$6,439,037	\$19,631,211
Atlantic Packaging Products Ltd.	Ontario	\$2,268,430	\$7,959,404
Available Energy Corp.	Ontario	\$1,020,000	\$2,375,257
BESTECH (Boudreau-Espley-Pitre Corp.)	Ontario	\$1,448,000	\$4,494,502
BioDiesel Reactor Technologies Inc.	Ontario	\$3,448,000	\$7,908,032
BIOX Canada Ltd.	Ontario	\$5,000,000	\$44,423,977
Blue-Zone Technologies Ltd.	Ontario	\$2,700,000	\$8,335,521
Calisolar Inc.	Ontario	\$4,074,505	\$15,656,809
Canada Lithium Corp.	Ontario	\$6,500,000	\$20,303,893
Canadian Pallet Council	Ontario	\$1,058,755	\$2,428,338
Chinook Mobile Heating and Deicing Inc.	Ontario	\$3,063,766	\$7,378,282
Cleeve Technology Inc.	Ontario	\$710,000	\$2,200,000
DeCloet Greenhouse Manufacturing Ltd.	Ontario	\$176,434	\$556,821
Duropar Technologies Inc.	Ontario	\$2,829,000	\$6,348,674
Dynamic Systems Inc.	Ontario	\$738,531	\$2,028,081
eCAMION Inc.	Ontario	\$5,435,749	\$16,307,248
Echologics Engineering Inc.	Ontario	\$1,051,926	\$3,217,390
EcoSynthetix Corp.	Ontario	\$2,100,000	\$6,381,875
EcoSynthetix Corp.	Ontario	\$1,679,331	\$5,088,882
EcoVu Analytics Inc.	Ontario	\$1,035,555	\$3,165,715

Lead Organization	Province	SDTC Funds	Total Eligible Project Costs
Ontario			
Electro Kinetic Solutions Inc.	Ontario	\$2,116,140	\$6,348,419
Electrovaya Corp.	Ontario	\$1,859,530	\$5,634,940
Electrovaya Corp.	Ontario	\$8,224,171	\$26,320,173
EnerMotion Inc.	Ontario	\$1,100,000	\$2,753,598
Ensyn Technologies, Inc.	Ontario	\$2,000,000	\$8,895,871
Entropex Ltd.	Ontario	\$6,330,000	\$25,024,389
EnviroTower Inc.	Ontario	\$300,000	\$937,500
FibraCast	Ontario	\$1,947,736	\$5,902,229
Fifth Light Technology Ltd.	Ontario	\$3,911,300	\$12,836,640
Fifth Light Technology Ltd.	Ontario	\$3,036,000	\$9,200,000
GaN Systems Inc.	Ontario	\$1,500,000	\$5,156,209
General Electric Canada (Locomotive)	Ontario	\$3,903,394	\$11,721,903
General Electric Canada (Microgrid)	Ontario	\$2,485,395	\$7,456,183
GreenField Ethanol Inc.	Ontario	\$3,649,019	\$12,042,966
GreenMantra Technologies	Ontario	\$2,007,450	\$6,083,181
Hydrogenics Corp.	Ontario	\$2,248,493	\$7,917,229
Hydrogenics Corp.	Ontario	\$1,350,419	\$3,069,135
Hydrostor Inc.	Ontario	\$2,171,011	\$5,867,597
Imtex Membranes Corp.	Ontario	\$2,753,948	\$8,735,378
Integran Technologies Inc.	Ontario	\$5,616,635	\$17,197,659
Integran Technologies Inc.	Ontario	\$1,481,328	\$4,464,522
InvoDane Engineering Ltd.	Ontario	\$2,467,125	\$8,797,123
Lakeshore EMPC Two L.P.	Ontario	\$1,037,669	\$2,494,397
Leapfrog Lighting Inc. (formerly Group IV Semiconductor Inc.)	Ontario	\$3,724,663	\$12,016,734
Macrotek Inc.	Ontario	\$1,953,700	\$5,863,291
Magenn Power Inc.	Ontario	\$691,119	\$5,435,581
Maratek Environmental Inc.	Ontario	\$915,205	\$3,256,110
Mikro-Tek Inc.	Ontario	\$500,400	\$3,483,350
Mining Technologies International Inc.	Ontario	\$613,261	\$1,849,909
Morgan Solar Inc.	Ontario	\$2,067,778	\$6,265,994
Morgan Solar Inc.	Ontario	\$2,351,580	\$9,299,472
Netistix Technologies Corp.	Ontario	\$471,199	\$1,169,206
NIMTech Inc.	Ontario	\$726,174	\$1,593,397

Section 7 – SD Tech Fund™ Portfolio by Region

Lead Organization	Province	SDTC Funds	Total Eligible Project Costs
Ontario			
Paradigm Shift Technologies Inc.	Ontario	\$1,955,250	\$5,449,356
Pathogen Detection Systems Inc.	Ontario	\$2,671,627	\$8,599,000
Performance Plants Inc.	Ontario	\$651,400	\$1,944,476
Plasco Trail Road Inc.	Ontario	\$9,494,466	\$71,144,194
Pratt & Whitney Canada Corp.	Ontario	\$5,624,850	\$17,565,575
PV Labs Inc.	Ontario	\$965,253	\$2,953,044
Science Applications International Corp. (SAIC Canada)	Ontario	\$1,009,589	\$4,846,556
SIREM ULC	Ontario	\$318,304	\$970,439
Solanfro Semiconductor Corp.	Ontario	\$3,800,000	\$11,600,500
Solanfro Semiconductor Corp.	Ontario	\$2,049,234	\$7,106,664
Solar Ship Inc.	Ontario	\$2,180,000	\$6,045,647
Spartan Bioscience Inc.	Ontario	\$1,896,774	\$6,354,802
Sunwell Technologies Inc.	Ontario	\$4,135,447	\$10,603,711
Temporal Power Ltd.	Ontario	\$4,123,000	\$12,023,000
Tenova Goodfellow Inc.	Ontario	\$1,522,513	\$6,168,902
Tenova Goodfellow Inc.	Ontario	\$3,322,441	\$11,077,549
Thermalfrost Inc.	Ontario	\$639,659	\$1,031,277
Tyne Engineering Inc.	Ontario	\$1,534,097	\$4,934,949
Ubiquity Solar Inc.	Ontario	\$3,122,445	\$9,992,106
Unicell Ltd.	Ontario	\$756,155	\$3,550,024
Verdant Power Canada ULC	Ontario	\$1,150,000	\$3,768,411
Vision EcoProducts Ltd.	Ontario	\$3,252,342	\$10,556,017
Vive Crop Protection Inc.	Ontario	\$3,954,706	\$11,038,603
Vive Crop Protection Inc.	Ontario	\$3,723,504	\$11,050,199
Wind Smart Inc.	Ontario	\$1,082,738	\$2,702,614
Woodland Biofuels Inc.	Ontario	\$4,275,000	\$12,900,000
Xogen Technologies Inc.	Ontario	\$1,974,104	\$4,227,077
Yava Technologies Inc.	Ontario	\$399,123	\$1,197,368
ZENON Environmental Inc.	Ontario	\$1,760,000	\$5,334,000
Zenon Membrane Solutions	Ontario	\$665,540	\$1,776,668
Total		\$210,812,083	\$729,683,655

Lead Organization	Province	SDTC Funds	Total Eligible Project Costs
Prairies			
Aboriginal Cogeneration Corp.	Manitoba	\$1,369,354	\$5,164,532
Borealis Geopower Inc.	Alberta	\$2,379,962	\$7,139,887
bstNRG.com Inc. (formerly Vidir Biomass Inc.)	Manitoba	\$1,651,169	\$3,669,264
Carbon Engineering Ltd.	Alberta	\$3,000,000	\$7,987,500
Eco-Ag Initiatives Inc.	Alberta	\$1,948,000	\$5,791,615
Great Northern Power Corp.	Alberta	\$2,063,403	\$7,265,541
Hifi Engineering Inc.	Alberta	\$2,000,000	\$6,000,000
Highmark Renewables Inc.	Alberta	\$1,000,000	\$7,056,245
Himark bioGas Inc.	Alberta	\$3,331,976	\$10,303,057
HTC Purenergy Inc.	Saskatchewan	\$585,414	\$1,511,718
Lancaster Wind Systems Inc.	Alberta	\$566,194	\$1,637,200
Luxmux Technology Corp.	Alberta	\$980,350	\$2,970,750
MEG Energy Corp.	Alberta	\$7,000,000	\$147,637,763
MEG Energy Corp.	Alberta	\$4,270,000	\$13,516,606
Milligan Bio- Tech Inc.	Alberta	\$7,004,493	\$28,141,614
MinMiner Oilisands Inc.	Alberta	\$3,435,372	\$12,635,945
MPT Mustard Products & Technologies Inc.	Saskatchewan	\$2,217,949	\$7,166,058
New Energy Corp. Inc.	Alberta	\$2,000,000	\$6,374,525
New Flyer Industries ULC Canada	Manitoba	\$3,400,000	\$9,980,404
NOVA Chemicals Corp.	Alberta	\$320,000	\$956,575
Nova Green Inc.	Alberta	\$1,838,152	\$5,748,335
N-Solv Corp.	Alberta	\$10,000,000	\$27,044,748
N-Solv Corp.	Alberta	\$4,155,843	\$15,806,359
Paragon Soil and Environmental Consulting Inc.	Alberta	\$231,151	\$527,743
Petroleum Technology Research Centre (Aquistore)	Saskatchewan	\$5,000,000	\$27,473,745
Petroleum Technology Research Centre (JIVE)	Saskatchewan	\$3,168,990	\$9,603,000
Prairie Pulp and Paper Inc.	Manitoba	\$1,237,290	\$3,521,525
Pure Technologies Ltd.	Alberta	\$1,000,000	\$3,015,000
Pure Technologies Ltd.	Alberta	\$1,000,000	\$3,000,000
Pure Technologies Ltd.	Alberta	\$795,000	\$2,508,335
Pure Technologies Ltd.	Alberta	\$2,200,000	\$6,840,562
Quantiam Technologies Inc.	Alberta	\$1,450,000	\$9,844,819
R.I.I. North America Inc.	Alberta	\$2,496,508	\$8,321,692

Section 7 – SD Tech Fund™ Portfolio by Region

Lead Organization	Province	SDTC Funds	Total Eligible Project Costs
Prairies			
Radiant Technologies Inc.	Alberta	\$1,000,000	\$2,528,144
Saskatchewan Power Corp. (SaskPower)	Saskatchewan	\$2,682,900	\$11,149,608
SBI BioEnergy Inc.	Alberta	\$1,875,495	\$6,161,571
Soane Energy (Canada) Inc.	Alberta	\$3,032,434	\$11,443,149
Soiless Technology Inc.	Alberta	\$2,500,000	\$7,575,668
Statoil Hydro Canada Ltd.	Alberta	\$6,000,000	\$38,791,337
Steeper Energy Canada Ltd.	Alberta	\$3,000,000	\$10,453,000
Suncor Energy Inc.	Alberta	\$889,132	\$3,555,669
Switchable Solutions Inc.	Alberta	\$5,200,000	\$15,600,000
Synodon Inc.	Alberta	\$1,056,790	\$4,572,871
Titanium Corp. Inc.	Alberta	\$6,292,635	\$21,526,442
Venmar CES Inc.	Saskatchewan	\$1,990,000	\$6,625,748
Verolube Inc.	Alberta	\$3,994,060	\$12,143,500
Verve Energy Solutions Inc.	Alberta	\$3,017,400	\$12,069,600
Western Hydrogen Ltd.	Alberta	\$1,480,000	\$4,492,123
Western Hydrogen Ltd.	Alberta	\$4,162,653	\$12,917,999
Whitefox Technologies Canada Ltd.	Alberta	\$2,608,545	\$6,983,099
Total		\$135,878,614	\$604,752,190
British Columbia			
Advanced Lithium Power Inc.	British Columbia	\$1,400,000	\$5,534,876
Altern Energy Inc.	British Columbia	\$1,254,317	\$8,891,092
Angstrom Power Inc.	British Columbia	\$169,752	\$1,263,271
Automotive Fuel Cell Cooperation Corp.	British Columbia	\$11,558,274	\$51,997,205
Ballard Power Systems Inc.	British Columbia	\$7,304,367	\$21,238,984
Ballard Power Systems Inc.	British Columbia	\$6,905,887	\$32,391,589
Carmanah Technologies Inc.	British Columbia	\$466,167	\$2,035,062
Clean Current Power Systems Inc.	British Columbia	\$1,582,000	\$4,795,500
CoolEdge Lighting Ltd.	British Columbia	\$4,180,000	\$12,179,015
Corvus Energy Ltd.	British Columbia	\$582,467	\$1,765,052
Diacarbon Energy Inc.	British Columbia	\$1,050,000	\$7,777,260
dPoint Technologies Inc.	British Columbia	\$1,531,394	\$3,582,961
EcoSmart Foundation Inc.	British Columbia	\$1,499,142	\$3,072,014
Etalim Inc.	British Columbia	\$2,936,530	\$7,531,399

Lead Organization	Province	SDTC Funds	Total Eligible Project Costs
British Columbia			
Exro Technologies Inc.	British Columbia	\$881,235	\$4,001,042
Fuseforward International Inc.	British Columbia	\$400,000	\$1,523,921
General Fusion Inc.	British Columbia	\$13,897,455	\$63,548,185
HTEC Hydrogen Technology & Energy Corp.	British Columbia	\$5,001,074	\$13,891,873
IBC Technologies Inc.	British Columbia	\$183,150	\$877,150
Inventys Thermal Technologies Inc.	British Columbia	\$3,100,000	\$9,492,458
Inventys Thermal Technologies Inc.	British Columbia	\$1,598,001	\$3,914,947
Lignol Innovations Ltd.	British Columbia	\$6,870,561	\$20,632,316
Lignol Innovations Ltd.	British Columbia	\$6,240,816	\$20,325,922
M.A. Turbo/Engine Ltd.	British Columbia	\$152,844	\$332,604
Middle Bay Sustainable Aquaculture Institute	British Columbia	\$3,645,291	\$11,945,628
Minesense Technologies Ltd.	British Columbia	\$4,435,794	\$13,441,800
MSR Innovations Inc.	British Columbia	\$680,839	\$1,473,397
*Namgis First Nation	British Columbia	\$4,150,000	\$11,423,360
Nexterra Energy Corp.	British Columbia	\$5,518,777	\$17,563,845
Nexterra Energy Corp.	British Columbia	\$1,159,518	\$3,513,692
Nutriloc Ingredients Corp.	British Columbia	\$847,319	\$2,404,493
NuWave Research Inc.	British Columbia	\$2,030,000	\$5,498,094
NxtGen Emission Controls Inc.	British Columbia	\$2,265,194	\$9,509,955
NxtPhase T&D Corp.	British Columbia	\$887,598	\$3,614,695
Ostara Nutrient Recovery Technologies Inc.	British Columbia	\$375,760	\$1,777,628
Paradigm Environmental Technologies Inc.	British Columbia	\$250,000	\$1,208,804
PAVAC Industries Inc.	British Columbia	\$3,549,865	\$10,526,620
PlugPower Canada Inc.	British Columbia	\$2,000,000	\$9,026,000
Polymer Research Technologies	British Columbia	\$1,116,826	\$3,350,478
Power Diagnostic Technologies Ltd.	British Columbia	\$1,191,107	\$3,489,382
Power Measurement Ltd.	British Columbia	\$1,702,882	\$5,108,646
Power Measurement Ltd.	British Columbia	\$2,960,871	\$9,104,666
Pulse Energy Inc.	British Columbia	\$2,556,801	\$8,552,915
Quadrogen Power Systems Inc.	British Columbia	\$2,910,145	\$7,441,221
RailPower Technologies Corp.	British Columbia	\$584,079	\$1,634,600
S2G Biochemicals Inc.	British Columbia	\$2,386,952	\$7,049,362
Sacr�-Davey Innovations	British Columbia	\$5,727,711	\$17,681,710

Section 7 – SD Tech Fund™ Portfolio by Region

Lead Organization	Province	SDTC Funds	Total Eligible Project Costs
British Columbia			
Saltworks Technologies Inc.	British Columbia	\$2,612,638	\$8,064,022
Saltworks Technologies Inc.	British Columbia	\$2,500,000	\$7,500,000
Segetis Inc.	British Columbia	\$15,000,000	\$83,000,000
semiosBIO Technologies Inc.	British Columbia	\$3,040,000	\$8,425,304
Shipstone Corp.	British Columbia	\$2,513,498	\$5,467,210
SunCentral Inc.	British Columbia	\$2,345,208	\$7,035,838
SunSelect Produce (Delta) Inc.	British Columbia	\$1,672,425	\$5,609,006
SWITCH Materials Inc.	British Columbia	\$2,363,621	\$8,046,780
Tantalus Systems Corp.	British Columbia	\$2,981,310	\$10,102,523
Unit Electrical Engineering Ltd	British Columbia	\$344,217	\$1,043,082
University of British Columbia	British Columbia	\$2,408,702	\$7,299,098
West Lorne Bio-Oil Co-Generation Ltd. Partnership	British Columbia	\$5,000,000	\$12,215,947
Westport Innovations Inc.	British Columbia	\$1,000,000	\$3,115,376
Westport Power Inc.	British Columbia	\$2,302,834	\$18,753,644
Whale Shark Environmental Technologies Ltd.	British Columbia	\$629,266	\$1,284,217
Xantrex Technology Inc.	British Columbia	\$1,213,614	\$3,677,618
ZincNyx Energy Solutions	British Columbia	\$2,900,000	\$9,025,684
Total		\$184,506,095	\$668,602,038

Section 8: NextGen BioFuels Fund™ - Introduction

Purpose

The purpose of the NextGen Biofuels Fund™ is to:

- Facilitate the establishment of First-of-Kind Large Demonstration-scale facilities for the production of next-generation renewable fuels and co-products;
- Improve the sustainable development impacts arising from the production and use of renewable fuels in Canada; and,
- Encourage retention and growth of technology expertise and innovation capacity for the production of next-generation renewable fuels in Canada.

The NextGen Biofuels Fund™ incorporates a requirement that all contractual agreements between SDTC and Eligible Recipients include repayment terms based on free cash flow over a period of 10 years after project completion.

Eligible Projects

To be eligible, a project must:

- Be a first-of-kind facility that primarily produces a next-generation renewable fuel at large demonstration-scale;
- Be located in Canada; and
- Use feedstocks that are or could be representative of Canadian biomass.

Funding Criteria

The Foundation will exercise its discretion in the allocation of funding to Eligible Recipients, in accordance with the following criteria:

- The Eligible Recipient's access to the necessary technical, financial and management capacity to successfully undertake the Eligible Project;
- The level of necessary funding required from the Foundation to ensure that the Eligible Project proceeds;
- The potential of the production pathway to deliver sustainable development benefits (social, economic and environmental) by:
 - sustainably expanding renewable fuel production in Canada;
 - improving the environmental benefits arising from the production and use of renewable fuels including the life-cycle fossil energy balance and life-cycle emissions of greenhouse gases;
 - reducing the overall financial costs of Renewable Fuels; and,
 - generating economic benefits for a wide range of communities.

More detail on the funding process can be found in the Funding section of the SDTC website at: www.sdtc.ca

Section 9: NextGen BioFuels Fund™ - Project Descriptions

The overall next generation biofuels industry deployment has been slower than expected which has impacted fund disbursement. Challenges with respect to technology and availability of investment capital persist with a deployment trend of initial commercial biofuel plants at small scale. While a longer-term outlook for competitiveness of the next generation biofuels industry is likely, some short term opportunities for advanced biofuels and co-products exist in Canada. The importance of biochemical and bioenergy technology development along the path to realizing a competitive advanced bio-fuels industry is also noted.

As of December 31, 2013, two Applications for Funding (AFFs), the Mascoma Drayton Valley Biorefinery (Drayton Valley, AB) and the Vanerco Project by Enerkem and Greenfield Ethanol (Varenes, QC), were active and progressing under the NGBF Project Assurance Process (PAP). Total project costs pertaining to the two active Applications for Funding amounted to \$512.3M with estimated NGBF funding totaling \$177.8M. In 2013 a funding decision was made to continue support for phase 3 project development for the Vanerco Project. Six (6) Indications of Interest (IOIs) were received in 2013 that represent potential NGBF applicants. Related total project costs of the eight (8) IOIs on hand in 2013 amounted to \$1.3B.

Projects

Vanerco

Total Project Costs*: **\$127,200,000**
 Potential SDTC Contribution*: **\$39,800,000**
 SDTC Contribution To Date: **\$734,000**

Enerkem Inc. (“Enerkem”), in partnership with Greenfield Ethanol Inc. (“GFE”), intends to implement the Vanerco Project (“Vanerco”). The \$127.2 M cellulosic ethanol facility will be located in Varenes, QC, on a brown field site where GFE currently operates a corn ethanol plant. The facility will convert 100,000 metric tonnes per year (mtpy) of urban waste into 38 M litres of cellulosic ethanol. The Enerkem thermo-chemical process which is currently being demonstrated in Westbury, QC with support from SDTC’s SD Tech Fund™ includes feedstock preparation, gasification of biomass, syngas conditioning and catalytic synthesis of ethanol.

Partners

Enerkem Inc.
 GreenField Ethanol Inc.

Mascoma Drayton Valley Biorefinery

Total Project Costs*: **\$385,100,000**
 Potential SDTC Contribution*: **\$138,000,000**
 SDTC Contribution To Date: **\$643,000**

Mascoma Canada Inc. (“Mascoma”), intends to implement the Mascoma Drayton Valley Biorefinery (“MDVB”). The \$385.1 M cellulosic ethanol facility will be located in Drayton Valley AL, on a brown field site in the Bio Mile biotechnology industrial cluster. MDVB proposes to convert woody biomass into 83 M litres of cellulosic ethanol and co-products annually. The MDVB process includes fibre preparation, feedstock pretreatment, Consolidated Bioprocessing (CBP), distillation and drying, Isopropanol (IPA) production, xylose purification, and power generation via the production of fuel-grade lignin. Pre-commercial demonstrations are run in Rome, NY.

Partners

Mascoma Corp.
 Catchlight Energy
 Xylitol Canada

* Final project costs and contributions are subject to assessments of project development, implementation achievements and a Final Investment Decision. For NGBF Funding process, see Funding section at www.sdte.ca.