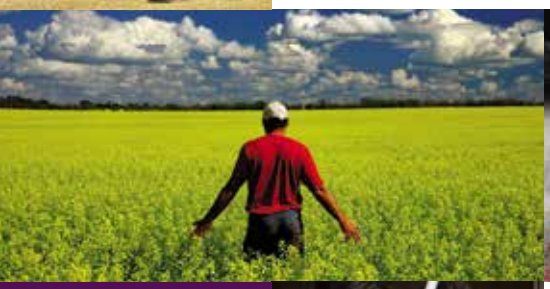
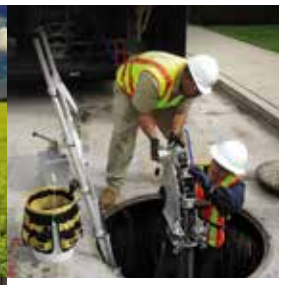




#ThisIsCleantech




Sustainable Development
Technology Canada

Annual Report Supplement 2014

2014 Annual Report Supplement

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 2014.

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.

Section 1: Index of Portfolio Companies Whose Project was Announced, Completed or Reported Market Impacts in 2014

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, and 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), CO_2 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 CO_2 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;

- 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; or
- 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 Funds section of the SDTC website at: www.sdtc.ca

Section 3: SD Tech Fund™ – Descriptions of Portfolio Projects Announced in 2014

This section of the report provides a brief description for each active project announced for funding in 2014.

Information on the projects completed in 2014, and those reporting on market impacts, can be found in section 4 of this report.

Cleeve Technology Inc.

Environmental Benefits: Clean Water / Clean Soil

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

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% of a medium-sized commercial aircraft.

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

Electro-Kinetic Solutions Inc.

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

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

GreenMantra Technologies

Environmental Benefits: Climate Change / Clean Air / Clean Soil

Total Project Value:
$6,083,181
SDTC Funding:
$2,007,450
Leveraged Funding:
$4,075,731

Wax represents a $10 billion global industry that has a high dependence on fossil fuels: 94% 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.

Morgan Solar Inc.

Environmental Benefits: Climate Change / Clean Air

Total Project Value:
$6,518,272
SDTC Funding:
$2,067,778
Leveraged Funding:
$4,450,494

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

Ubiquity Solar Inc.

Environmental Benefits: Climate Change / Clean Air

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

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 Advaced 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

Section 4: SD Tech Fund™ – 2014 Completed Projects

This section provides a summary of projects completed, or reporting on Market Impacts, in 2014.

For each completed project, the project results have been highlighted and an evaluation of the Project Impact[1] 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.

Reports are accurate as of the date of presentation of the report regarding impact on the market.

A full listing of all completed projects can be found in the Results section of SDTC's website under Projects.

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 2014, 20 projects completed close to year end and will be reported next year once the final reports are received.

Dynamic Systems Inc.

Round 9-2006A

Sector:
Transportation

Project Delivery Completion:
January 2012

Market Impact Report Due:
January 2014

Total Project Value:
$2,028,081

SDTC Funding:
$738,531

Leveraged Funding:
$1,289,550

Consortium Members:
Dynamic Systems Inc.
International Truck and Engine Corp.

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

Project Title:

Transmission-less Hybrid Drive System

Project Description:

Dynamic Systems (DSI) was to develop and demonstrate a transmission-less hybrid drive system (THDS) incorporating a Multi-stage Switched Reluctance Motor (MSRM) and energy management system to replace current mechanical transmissions in Class 4-6 and Class 7-8 commercial transport vehicles. The problem of motor vibration has been overcome in the DSI Multi-Stage design. Use of the DSI THDS technology in combination with hybrid electric power trains has the potential to reduce the consumption of diesel fuel by up to 60%.

Objectives:

- Build and demonstrate pre-production models of the MSRM-THDS system in two market segments (Alpha Demonstration):
  - 10 short-haul trucks (Class 6)
  - 10 long-haul trucks (Class 8)
- Reach 50% to 60% reduction in fuel consumption and 70% to 80% reduction in atmospheric emissions.
- Undergo Beta Demonstration of commercial viability of the design under actual fleet conditions (180 vehicles) partnering with a major OEM.

Results:

- Modelling and impact studies were performed that confirmed the potential impact of the technology.
- The details of the motor, generator, controller, and battery systems for the THDS architecture were developed and technical benefits were confirmed.
- Dynamometer testing of the Diesel Engine Waste Energy Recovery (DEWER) technology was completed. This other application of the technology also showed significant potential for emission reductions.
- Due to the state of the financial markets in 2008 and the subsequent lack of financial resources the project was put on hold and no further results were achieved.

Project Impacts:

- This project produced a new design for a new THDS with an MSRM for short- and long-haul trucks. A study undertaken by Ricardo Inc. confirmed the potential for superior performance and commercial benefits of the system for these applications. By inserting MSRM packages between diesel engines and standard transmissions, the system is able to recover waste energy in the form of electrical energy with the Electric Turbo Compound technology (DEWER) and convert it to mechanical energy.

Path to Market:

- DSI intended to work in close collaboration with partners to establish a path to market for the technology.

Market Impact:

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

Pure Technologies Ltd.

Round 8-2005B

Sector:
Energy Utilization

Project Delivery Completion:
January 2012

Market Impact Report Due:
January 2014

Total Project Value:
$6,840,562

SDTC Funding:
$2,200,000

Leveraged Funding:
$4,640,562

Consortium Members:
Pure Technologies Ltd.
Hyprescon Inc.
Halifax Regional Water Commission
City of Calgary Water Services
City of Hamilton

Environmental Benefits:
(primary benefit bolded)
Clean Water
Climate Change
Clean Soil

Project Title:

Robot Device for Pipe Inspection

Project Description:

Pure Technologies Ltd. and its consortium developed and demonstrated a suite of "PipeDiver® inspection tools", robotic devices that inspect small diameter (SD:24" to 48") and large diameter (LD: 60" to 160") pre-stressed concrete cylinder pipe (PCCP), and metallic pipes (MP), ranging in diameter from 16" to 66" used for water and wastewater transportation. The devices enable the identification of distressed pipe, enabling utilities to minimize operational risks, optimize their investment, and extend the safe and economic life of their pipelines, saving themselves, and taxpayers, millions of dollars. Canada's concrete and metallic pressure pipe infrastructure is aging, and is starting to decay. While the risk of pipe failure is low, failures can be catastrophic. Such failures result in interruptions to the water supply as well as damage to adjacent pipes, infrastructure and property.

Objectives:

- Develop a free swimming system that can:
  - conduct electromagnetic inspection for small and large diameter PCCP water lines (24" to 60" and 60" to 160"); and,
  - conduct electromagnetic inspection in metallic pipes ranging from 16" to 66" in diameter.
- These inspections were to be conducted on water lines in live condition.

Results:

- The proponent successfully designed and demonstrated PipeDiver® tools for the three project applications. The PCCP demonstrations identified pipe anomalies that could lead to failures. Metal pipe calibration identified weaknesses and field trials showed one anomaly not weakness related. The main environmental benefit of the technology is water savings.

Project Impacts:

- Should the pipe identified in the small diameter PCCP demonstration be replaced, approximately 20 ML of water could be saved and GHG emissions could be reduced by 1.1 t CO_2e.
- Since the risk of failure was low in most cases, it was assumed that none of the pipes inspected would be replaced as a result of the inspection, and therefore there was no project impact from the testing.
- PipeDiver® tools had inspected over 500 km of pipeline by the end of 2012. Water potentially conserved (as not all pipe was replaced due to the presence of leaks and pipe distress) due to pipeline inspections was approximately 100 ML.

Path to Market:

- Pure Technologies has commercialized the PipeDiver® technology, targeting water and wastewater utilities and pipeline owners in Canada, the United States and selected international markets as appropriate.
- Projects with several municipalities in various jurisdictions are underway.
- PipeDiver® complements other pipe inspection tools in the Pure Technologies' suite of tools (e.g. Sahara®) to provide a full range of pipe condition and leak detection assessments to municipalities.

Market Impact:

- Pure's PipeDiver® tools have assessed over 1000 kilometres of pipeline for structural defects. The results of these inspections have been very valuable, with approximately 200 million litres of water saved from averted pipe failures. In addition, municipalities have saved millions of dollars combined by proactively managing pipelines to prevent critical failures.

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

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 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 & 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 CO_2e/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 were installed on 350,000 wells in the United States, this could result in GHG emissions reductions of approximately 625 kt CO_2e over 10 years. This could 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 began commercializing its IVT technology in 2012. The technology was 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 was saving $5,500 annually due to the installation of an IVT on one of its 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 could have been applied to approximately 25% of all existing and new wells; or about 350,000 wells in the United States over a period of five years. Turbo Trac planned to grow from less than $500,000 in revenue in 2012 to approximately $30 million in 2017.

Market Impact:

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

SiREM ULC

Round 8-2006B

Sector:
Waste Management

Project Delivery Completion:
February 2012

Market Impact Report Due:
February 2014

Total Project Value:
$970,439

SDTC Funding:
$318,304

Leveraged Funding:
$652,135

Consortium Members:
SiREM ULC
Magellan Aerospace Corp.

Environmental Benefits:
(primary benefit bolded)
Clean Water
Clean Soil
Climate Change

Project Title:

Bioaugmentation Demonstration with KB-1®

Project Description:

SiREM demonstrated the first Canadian application of KB-1® for in situ biodegradation of chlorinated solvents in cold groundwater and fractured bedrock conditions. Tetrachloroethene (PCE) and trichloroethene (TCE) are among the most commonly detected chlorinated volatile organic compounds (VOCs) in soil and groundwater. To date, other microbial approaches to treating these solvents have had limited success. KB-1® biodegrades these toxic solvents into non-toxic ethene. This demonstration showed that bioaugmentation with KB-1® can be a cost-effective cleanup strategy for PCE and TCE contaminated sites, particularly under Canadian climatic and fractured bedrock site conditions.

Objectives:

- Demonstrate bioaugmentation with KB-1® is an effective, safe, reliable and economical remediation technology for sites with chlorinated solvent contamination in Canada.
- Demonstrate the effectiveness of bioaugmentation in cold groundwater temperatures and in solvent contaminated bedrock.
- Demonstrate the effectiveness of bioaugmentation at the Fleet Industries Ltd. site in Fort Erie, Ontario.

Results:

- KB-1® was introduced to the Fleet Industries Ltd. site in the first year of the project (October 2009). The groundwater chemistry was evaluated before, during, and after the project in order to assess the effectiveness of KB-1® in enhancing in-situ bioremediation of existing chlorinated solvents in the aquifer.
- Data showed that concentrations of chlorinated VOCs in the extracted groundwater continually decreased, while concentrations of ethene increased (ethene results from the dechlorination of TCE). The results showed that KB-1® promoted the transformation of VOCs to ethene.
- In the first year of evaluation, groundwater VOC concentrations decreased by more than 90% at monitoring wells in the treatment area. The concentration of VOCs remained below historical levels in the second year as well.

Project Impacts:

- The environmental benefits of bioaugmentation with KB-1® include a potential decrease in length of time to remediate a site and associated decrease in energy and resource inputs (i.e., reduced consumption of electricity and fossil fuels, both onsite and in the transportation of samples).
- GHG emissions reductions associated with the demonstration project (for one unit over the duration of the remediation process) were estimated to be 4,104 t CO_2e/site.
- Additional reductions in CAC emissions for the demonstration project were estimated to be: 0.96 t SO_x/yr; 3.42 t NO_x/yr; 0.24 t PM/yr; 0.9 t CO/yr; 0.25 t VOC/yr (excluding TCE, PCE, VC); and 0.0297 t VOC/yr (of TCE, PCE, VC).

Path to Market:

- It is assumed that approximately 40% of the chlorinated solvent-contaminated sites in Canada would be suitable for bioaugmentation. It is also assumed that new contaminated sites suitable to bioaugmentation will be discovered at a rate of 5 to 10/year.

Market Impact:

- The application of bioaugmentation and related laboratory testing has accelerated in Canada in part due to the profile and knowledge gained through the project.
- As of February 2015, 19 sites in Canada had been bioaugmented with KB-1 in Canada.
- 11 cold groundwater sites in Denmark and Sweden, and several in the northern USA (e.g., Wisconsin, Michigan, Maine and Alaska) have also been bioaugmented.
- Bioaugmentation cultures applied to cold groundwater sites and related testing now represents approximately 5% of SiREM's total revenue.

Unicell Ltd.

Round 8-2005B

Sector:
Transportation

Project Delivery Completion:
February 2012

Market Impact Report Due:
February 2014

Total Project Value:
$3,550,024

SDTC Funding:
$756,155

Leveraged Funding:
$2,793,868

Consortium Members:
Unicell Ltd.
Meritor Heavy Vehicle Systems LLC
Electrovaya Inc.
Purolator Courier Ltd.
Transportation Development Centre

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

Project Title:

Lightweight Electric Urban Delivery Vehicle

Project Description:

Unicell Ltd. and its consortium partners developed and demonstrated the environmental benefits and operational advantages of an all-electric, lightweight composite monocoque urban delivery vehicle in typical Canadian operating conditions. The target for these QuickSider vehicles is to replace conventional gasoline-powered Curbsider delivery vans, eliminating on-street emissions and reducing greenhouse gas emissions by more than 80%.

Objectives:

- Demonstration of the technical capability and the environmental and economic advantages of the QuickSider in fleet use under typical Canadian conditions including target minimum service life, reduced total daily energy requirements, zero tail pipe air emissions in operation, and improved daily productivity of truck and driver.

Results:

- Based on QuickSider prototype testing at Transport Canada:
  - 80% GHG emissions reduction was measured compared with the conventional Curbsider;
  - the QuickSider prototype exhibited an overall efficiency over urban drive cycle of >60%, nearly three times that of the Curbsider;
  - for highway driving, the QuickSider's efficiency was >50%, double that of the Curbsider.
- Based on a drive cycle analysis and base number of driver exits/entries per day, daily productivity of truck and driver could be improved by ~7%.

Project Impacts:

- During the project there were no significant environmental impact reductions realized as the fleet demonstration was not fully undertaken as originally intended.

Path to Market:

- While Unicell has secured a Letter of Intent to purchase vehicles, market and financial constraints resulting from the 2008/2009 economic downturn have delayed the commercialization of the QuickSider vehicle. Unicell continues to work with Purolator and is in discussions with other courier and delivery companies for the continued development and demonstration of the QuickSider vehicle.

Market Impact:

- Sales of BEV delivery trucks are still tiny compared to their potential and have actually shrunk over the past two years, as all but two companies have either gone out of business or suspended production. Customers have been disappointed by very high initial costs, particularly for battery packs and charging infrastructure, frequent breakdowns, poor service, and poor actual range, particularly in cold weather. Furthermore, the failure rate of the small companies that have comprised the industry to date and the absence of the established OEMs have made prospective customers skeptical of the long term service support and viability of such trucks.
- Despite these current issues, there is a strong latent demand for a well executed, well supported electric delivery truck not only among large, highly visible customers such as FedEx, UPS, Frito-Lay, Purolator and the US and Canadian post offices, but also among many smaller ones.
- Unicell continues to believe in the medium term success of electric delivery trucks in general and the QuickSider in particular. Purolator's interest is still strong. Unicell is working with two large potential partners to move the project forward.

Pure Technologies Ltd.

Round 12-2007B

Sector:
Waste Management

Project Delivery Completion:
April 2012

Market Impact Report Due:
April 2014

Total Project Value:
$2,508,335

SDTC Funding:
$795,000

Leveraged Funding:
$1,713,335

Consortium Members:
Pure Technologies Ltd.
Halifax Regional Water Commission
City of Calgary Water Services
Toronto Water

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

Project Title:

Advancements to Sahara® Leak Detection Technology

Project Description:

Pure Technologies Ltd. (formerly The Pressure Pipe Inspection Company) developed and demonstrated an enhanced version of their Sahara® water pipe leak detection technology that includes higher pressure deployment, video functionality, sewer application, propulsion for no-flow conditions (e.g. new pipe installations) and improved quantification algorithms. Improved leak detection will result in lower leakage loss of potable water, less disinfection chemical discharges to the environment, less leakage of ground water into sewage pipes and less GHG emissions from reduced pumping energy to replace lost water.

Objectives:

- Expand the technical capabilities of the Sahara® leak detection system for sewer, higher pressure and no-flow conditions.
- Live video inspection functionality and the development of leak quantification algorithms.

Results:

- Sahara® advancements which included a combined audio and video (A/V) sensor, dual hydrophone array, fiber optic cable, acoustic pipe wall assessment (PWA) and new leak quantification algorithms.
- Field trials were conducted on live pipelines in several locations throughout the world (e.g. Canada, Hong Kong, Manila, USA) for a total of approximately 330 km of water and wastewater pipeline inspected. No leaks were found in wastewater pipelines, although Sahara® detected gas pockets, but potable water field trials reported leaks at a rate of 1.75 leaks/km on average. Average water loss reported was 7.33 m^3/hr.

Project Impacts:

- The potable water project demonstration detected pipe leaks, resulting in potential reductions in water loss of 7,271 ML and potential GHG emissions reductions of 444 t CO_2e in Canada (as not all pipes were replaced due to the presence of leaks). Potential reductions of 258,719 ML of water lost and 38 kt CO_2e were reported for the rest of the world.
- The project also resulted in potential small CAC emissions reductions mainly as a result of a reduction in electricity production.
- The wastewater project demonstration did not result in any detection of pipe leaks.

Path to Market:

- Pure Technologies has commercialized the advanced Sahara® platform, targeting water and wastewater utilities and pipeline owners in Canada, the United States and selected international markets as appropriate.
- Projects with several municipalities in various jurisdictions are underway.
- Sahara® complements other pipe inspection tools in the Pure Technologies' suite of tools (e.g. PipeDiver®) to provide a full range of pipe condition and leak detection assessments to municipalities.

Market Impact:

- Pure's Sahara® leak detection tools have assessed more than 1000 kilometres of pipeline to date, resulting in approximately 80 million m^3 of water saved per year due to proactive leak detection programs.

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 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 CO_2e/year. Over the next 15 years, cumulative emission reductions are estimated to be 170 t CO_2e.

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.

Market Impact:

- There is a demand in the market for CVTCorp's product, however, since it is a new technology CVTCorp expects a long process to adopt the change.
- Goal is to launch production in 2016.

Middle Bay Aquaculture Institute

Round 10-2006B

Sector:
Agriculture

Project Delivery Completion:
June 2012

Market Impact Report Due:
June 2014

Total Project Value:
$11,230,327 (pending final audit)

SDTC Funding:
$3,645,291

Leveraged Funding:
$7,585,036

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 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 kilowatt/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.

Market Impact:

- Despite the setback of the prototype at Middle Bay, AgriMarine was successful at demonstrating the commercial value of the technology for sustainable aquaculture. The successes of rearing salmon within an enclosed environment included demonstrating excellent growth rates, effectively avoiding sea lice infestations, as well as rearing healthy fish without the need for antibiotics. Ancillary life support and mooring systems also functioned as designed. The following market impacts were realized:
  - The project generated sufficient data to enable design and production of a new ocean ready system for the greatly expanded Total Addressable Market (TAM) size.
  - AgriMarine/Middle Bay acquired a commercial farm and four tanks were installed with more under construction.
  - External new capital, ten times larger than the contribution amount, was attracted to further the commercial deployment of the technology in the marketplace.
  - The first sale of the technology to a foreign customer is now underway with two tanks en route to Norway where the technology has great promise in the post smolt production sector.
  - Negotiations are in progress with a primary Norwegian salmon producer exploring the use of the tanks for full scale grow-out, and.
  - AgriMarine are now receiving enquiries for sales from around the world from such places as Mexico, Turkey, Africa and Chile.

TM4 Inc. (Vehicle)

Round 11-2007A

Sector:
Transportation

Project Delivery Completion:
June 2012

Market Impact Report Due:
June 2014

Total Project Value:
$12,377,524

SDTC Funding:
$3,818,787

Leveraged Funding:
$8,558,737

Consortium Members:
TM4 Inc.
TATA Autocomp System Ltd.
Institut du transport avancé du Québec (ITAQ)

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

Project Title:

TM4 Electric and Hybrid Vehicle Drive

Project Description:

TM4 designed, developed and demonstrated a new automotive electric power train based on TM4's high density permanent magnet motor. TM4 developed a permanent magnet, outer rotor, electric motor technology, power electronics and control technologies which will enable car manufacturers to offer superior gasoline-electric hybrid technology. The Electric All Wheel Drive (E AWD) system uses stored electric energy to send torque and power to the rear wheels from standstill through vehicle acceleration and whenever more torque or traction is required. The E AWD system recharges the battery pack through regenerative braking and during coasting. It is able to operate in Zero Emissions Vehicle (ZEV) mode under limited load conditions.

Objectives:

- Design and integrate a Rear Electric Motor (REM) in a Hybrid Vehicle (HV) to generate and store electric energy and provide boost power for improved vehicle acceleration, torque and traction.
- Develop a generic system design that can be used on a wide range of vehicle applications.
- Meet the following specifications:
  - Target cost of < $4,000 for the eventual industrial version.
  - Weight of 51 kg for the entire system.
  - 37 kW of continuous power output (max 80 kW).
  - 65 Nm of continuous torque output (max 170 Nm).
  - Speed of 10,000 to 12,000 rpm.
  - 91% system efficiency.
- Design to OEM specifications.
- Launch a manufacturing JV company with an automotive OEM to be situated in Quebec and sign an OEM purchase order for volume production.

Results:

- The 37 kW system was developed, assembled, integrated into vehicles and tested.
- The system was tested in different types of vehicle (HV and EV) from sub-compact size to SUV.
- The design of the system was completed in close collaboration with OEM clients.
- All specifications developed with manufacturers were achieved as stated in the objectives.
- Over 30 prototypes were sent to potential clients for testing.

Project Impacts:

- Emission reductions resulted from reduced energy consumption (including fuel) from the production and transportation of fuel and from vehicle operations.
- GHG emissions reductions associated with the EV demonstration project (over a distance of 2,700 km) were estimated to be 406 kg CO_2e.
- GHG emissions reductions associated with the HEV demonstration project (over a distance of 339 km) were estimated to be 41 kg CO_2e.

Path to Market:

- TM4 received orders totaling 200 units from TATA.
- The company is currently negotiating an agreement with another manufacturer for large volume orders.
- Over 20 prototypes were provided to potential clients for testing in North America, Europe and Asia.

Market Impact:

- As a first major project the system was selected by Tata Motors for a fleet of demonstration vehicles in the UK from 2009-2012. Other customers include Karmann GMBH (now part of Volkswagen) for the E3 fleet program, Blade Electric Vehicles in Australia and many more. It was also sold to more than 30 new customers, ranging from OEMs, integrators, engineering firms and universities.
- TM4 sold hundreds of the first generation of this powertrain and started to commercialize a new version in 2012 that improved power density over its predecessor. By allowing the motor and inverter (the two main components of the MOTIVE system) to be sold separately, TM4 has attracted customers that had already selected one of the latter components. As a result, the TM4 CO150 inverter (successor to the inverter of the first generation MOTIVE system) was selected by a large integrator and was produced in quantities of approximately 1,000 units for 2014.

TM4 Inc. (Wind)

Round 10- 2006B

Sector:
Power Generation

Project Delivery Completion:
June 2012

Market Impact Report Due:
June 2014

Total Project Value:
$3,347,002

SDTC Funding:
$622,542

Leveraged Funding:
$2,724,460

Consortium Members:
TM4 Inc.
Marmen Inc.

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

Project Title:

TM4's 2.5-MW Permanent Magnetic Generator (PMG) Wind Demonstration

Project Description:

Two key issues facing the wind industry are managing the power-to-weight ratio as turbine size and tower height rises and the high failure rate of mechanical drive trains. TM4 applied their existing permanent magnet wheel motor electrodynamics machine technology to a mid-size permanent magnetic generator. They demonstrated the advantages of their technology, which features high power density and high efficiency over a wide range of operating speeds. The goal was to reduce total generator weight by at least 50% and volume by 30%, compared to conventional double-fed induction generators. This would enable taller, less expensive towers and nacelles, resulting in a wind turbine that could deliver a greater power output.

Objectives

Develop and demonstrate a permanent magnetic generator (PMG) capable of maintaining high efficiency over a wide speed and power range in wind turbine applications.

- Scale up from 200 kW to 660 kW to 3 MW PMG for wind power.
- 50% weight reduction and 30% volume reduction compared to doubly-fed induction generators (DFIG).
- Greater efficiency than DFIG over a wide range of operating speeds.
- Conform to class H insulation material allowing high temperature operation, up to 50% power overload for 30 seconds.
- 6-phase arrangement to decrease harmonics (topology: 2 sets of 3 phases with 30-degree delay).

Results:

The 660-kW PMG was developed assembled and tested.

- Efficiency, weight and size targets were achieved:
  - Efficiency of 97.3%.
  - Weight of 1,600 kg.
  - Diameter of 1,020 mm.
- Tests were successfully performed for full nominal power, acoustic noise level, insulation, aerodynamic losses and accelerated aging.

The proposed scale-up from 660 kW to 3 MW PMG for wind power was not achieved during the project's time frame.

Project Impacts:

- This project produced a smaller, lighter and highly efficient 660 kW permanent magnetic generator (PMG), catalyzing interest for wind power generation and other applications such as hydrokinetics power generation.

Path to Market:

- TM4 received interest for the use of the 660 kW PMG in new wind turbines and retrofitted turbines.
- The company will showcase their technology in wind farms in remote areas.
- The architecture of the 660 kW PMG will be used in hydrokinetics power generation demonstrations, which broadens the potential market for the technology.

Market Impact:

- The project enabled TM4 to scale up its technology in size and demonstrate its capabilities. TM4 was able to increase its competence and credibility in designing high power products for the energy sector. As a result, TM4 won a contract with RER Hydro for the custom design of a generator for their hydrokinetic turbine.

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 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 224,770 fewer truckloads travelling 1 km; or to 2,248 fewer truckloads travelling 100 kms each or to 225 fewer trucks travelling 1000 km 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 CO_2, 4,142 gm/yr of SO_x, 121 t/yr of NO_x, 1,218 gm/yr of particulate matter being avoided.

Project Impacts:

- 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 CO_2e/day, or 187 t CO_2e/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.

Market Impact:

- Because of competitive dynamics, the cooperative nature of the CPC was deemed unattractive and all programs under the CPC were negatively impacted. Consequently, the realized reductions did not meet projected levels in 2013 and 2014 and the activity within ECT came to a full stop in 2014. The CPC will cease all operations in 2015.
- iLogic continues to market the platform under the masLogic™ brand in support of the efficient management of reusable assets.
- ECT can be divided into two main components: the optimization module and the data/user interface module. While the optimization module is very efficient and effective, work is required to redo the data/user interface module to make it more accessible and flexible for a wider range of uses. iLogic is in the process of seeking industry and/or government funding to complete the development of this data/user interface module.

Pratt & Whitney Canada Corp.

Round 6-2004B

Sector:
Transportation

Project Delivery Completion:
July 2012

Market Impact Report Due:
July 2014

Total Project Value:
$16,775,800

SDTC Funding:
$5,368,257

Leveraged Funding:
$11,407,543

Consortium Members:
Pratt & Whitney Canada Corp.
National Research Council
University of Toronto – Institute for Aerospace Studies

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

Project Title:

Low Emission Engine Technology for Air Transportation and Land Power Applications

Project Description:

Pratt & Whitney Canada explored incorporating fuel saving and emission reduction technologies in their new generation of engines. The technologies of interest were an advanced combustor, a fuel stabilization unit and a high-efficiency compact compressor impeller and diffuser components. The engine models selected for testing these modifications were light, medium and heavy jet aviation engines, although the technologies may eventually be applied to other new engines.

Objectives:

- Integrate low emission and fuel conditioning technologies into a family of advanced gas turbine engines.
- Reduce emissions from the current PW300-family of engines by the following: NO_x by 20%, CO by 45%, VOCs by 60%, PM by 75% and CO_2 by 2-3%.
- Ensure weight and cost goals are achieved.

Results:

- During this project, the following technologies were integrated into Pratt & Whitney's new generation engines: the improved TALON combustor; a fuel stabilization unit (FSU) coupled with a heat exchanger both to reduce emissions and reduce the potential for forming coke; and a high efficiency compact compressor impeller and diffuser components designed to increase compressor efficiency and reduce the engine specific fuel consumption (SFC).
- CAC emission reductions were achieved for NO_x. GHG reductions were achieved through improved fuel efficiency. The improved TALON combustor is compatible only with the heavy and medium size engines. Light engines were ruled out which resulted in elimination of the CAC emission reductions for these types of engines. The fuel stabilization unit and heat exchanger could be incorporated and would reduce fuel use; however the reduction calculated was too small for the investment to be considered justifiable.
- Optimization and testing of the medium and heavy engines are on-going and the interim results appear to be promising.

Project Impacts:

- Annual per engine GHG emission reductions of 0.22 and 33.55 t CO_2e are expected, respectively, for the light and medium engines. GHG emission reductions for the heavy engine were not measured at the time of project completion.
- Annual per engine NO_x emission reductions of 0, 0.30 and 0.36 t are expected, respectively, for the light, medium and heavy engines.

Path to Market:

- Optimization of the medium and heavy engine is on-going.
- Pratt & Whitney Canada entered the market with their medium engine in 2013. The first representative of the heavy engine is the PW814, that will power the Gulfstream G500 currently scheduled to enter service in 2018. This engine was certified in February 2015. By 2020, cumulative GHG savings are expected to be 24 kt CO_2e in Canada and 368 kt CO_2e in the rest of the world. Cumulative NO_x reductions during the same period are calculated to be 235 t in Canada and 3.6 kt in the rest of the world.

Market Impact:

- Elements of the compressor improvements developed under this project have been incorporated into the PW308C production engines since mid-2012. This engine is powering the Dassault Aviation Falcon 2000EX/DX.
- Pratt & Whitney is actively working with various aircraft OEMs to be able to launch engines programs for both regional turboprop and large business jet markets in the coming years.
- For the types of technologies developed under this project, a 10 year period between start of R&D and commercialization is the "norm" in the aero-engine industry.

Tantalus Systems Corp.

Round 8-2005B

Sector:
Power Generation

Project Delivery Completion:
July 31, 2012

Market Impact Report Due:
July 31, 2014

Total Project Value:
11,079,087

SDTC Funding:
2,981,310

Leveraged Funding:
8,097,777

Consortium Members:
Tantalus Systems Corp.
Chatham-Kent Hydro
McMaster University

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

Project Title:

TUNet™ Conservation and Demand Management (CDM) System

Project Description:

Tantalus demonstrated the use of their TUNet™ technology, an energy conservation and demand response system integrating wireless communications and smart thermostats for both residential and commercial customers, to reduce peak energy demands and to show emissions reduction potential in excess of what could be achieved through smart metering alone.

Objectives:

- Demonstrate energy conservation of 15% for residential and 6% for commercial TUNet™ applications beyond what is typically achieved with smart meters alone;
- Capital cost per end point of less than $100;
- Implementation of a scalable, two-way communications network capable of communicating with over two million residential and commercial customer end-points; and
- Real-time operational benefits (power quality monitoring, outage reporting, distribution automation, distributed generation (monitoring and control) etc.) to enhance the utility return on investment (ROI) beyond the reach of current communications technologies.

Results:

- In 2011 seventy-six households equipped with load management (LM) devices were subject to demand-management interruptions in the use of air-conditioning up to six times per month for the months of June, July, August and September 2011. These interruptions were for four consecutive hours between 11:00 am and 3:00 pm and results showed that 17.1%, 46.7%, 44.0% and 36.0% of the households showed significant reductions in load. The proposed late-stage pilot work had to be called off due to a change in market conditions, so the proposed energy conservation targets were not able to be fully validated.
- Although the initial pilot confirmed that the capital cost targets were attainable, the feedback was that the current generation of in-home displays was not going to be commercially feasible with the emergence of energy conservation via smart phone applications and home computing networks which led to the development of an in-home display ((IHD) that is based on a mobile smart phone/tablet application.
- On the software side, the Tantalus scalable network server was demonstrated to be capable of supporting two-way communications over one million end-points during a three-month pilot in Tennessee in 2012.
- Beyond the SDTC project Tantalus will be evaluating two emerging technologies: 1) an in-home display (IHD) that is based on a mobile smart phone/tablet application, and 2) a home computing gateway to coordinate home energy conservation.

Project Impacts:

- Absolute GHG emission reduction intensity for the pilot project using both operational and estimated data has been calculated at 446.67 kg CO_2e/year (equivalent to 2.23 kg CO_2e/customer/year).
- The estimated market roll-out total GHG emission reduction potential of the technology in Ontario by 2017 is 21.01 t CO_2e, while national roll-out has the potential to reduce GHG emissions by 1164.34 t CO_2e by 2017.
- Reductions in SO_x, NO_x, CO and VOC's were 7.07, 3.78, 5.69 and 3.42 t respectively.

Path to Market:

Tantalus will continue to sell the Smart Thermostat platform with the current generation radio platform to utilities for piloting purposes.

- To provide consumption reporting for the consumer, Tantalus will evaluate two technologies: 1) an in-home display (IHD) mobile/tablet application, and 2) a home gateway.
- An IHD Mobile Application will be developed using a third party vendor who can manage the security and platform support aspects. The IHD mobile application is intended to interact directly with a smart meter to provide clients with real-time conservation and demand management information.

Market Impact:

- Tantalus installed over 22,000 load management devices over the years 2012-2014. Tantalus is expanding their CDM product suite with the introduction of a new load management switch that is capable of providing near real time feedback, individually operated relay switches, and measurement and verification of the controllable load.

BESTECH (Boudreau-Espley-Pitre Corp.)

Round 8-2005B

Sector:
Energy Exploration and Production

Project Completion Date
September 2012

Market Impact Report Due:
September 2014

Total Project Value:
$4,494,502

SDTC Funding:
$1,448,000

Leveraged Funding:
$3,046,502

Consortium Members:
BESTECH (Boudreau-Espley-Pitre Corp.)
Vale INCO Ltd.
Centre of Excellence in Mining Innovation (CEMI)
MIRARCO - Mining Innovation Rehabilitation and Applied Research Corp.
Green Canal Holdings Inc.

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

Project Title:

Mines Emissions Reductions Initiative

Project Description:

BESTECH developed and demonstrated a new ventilation technology, "Ventilation on Demand" (VOD), which provided an automated deep mine ventilation control system. This Mine Emission Reduction Initiative (MERI) demonstrated VOD in five underground mining levels targeting energy reductions of approximately 12-20% by modifying ventilation to be targeted within the mining environment anywhere it is needed. The technology has led to energy savings as well as climate change and clean air benefits.

Objectives:

- Integrate NRG1- Energy Consumption Optimization (ECO) technology with monitoring and tracking devices in an underground mine.
- Test the NRG1-ECO technology within five levels of the Vale Inco Coleman MineReduce energy and related operating expenses by 12-20%, primarily electricity requirements for ventilation.

Results:

- Full system commissioning and testing at Coleman Mine was performed with a success rate of 96.7%. Technology deployed and full system commissioning and testing performed in a single level of Xstrata's Fraser Mine. Unfortunately, Xstrata's Fraser Mine experienced a major change in mode of operations which affected the ventilation system immediately after installing the project technology and therefore, the savings were not validated during the project.
- Movements of the tracking devices (or "tags") were successfully detected on all five levels. The tests performed indicated that NRG1-ECO consistently detected all tag movements which occurred in the system and calculated sufficient airflow. Tests performed indicated that the NRG1-ECO system successfully reacts to contaminants.
- Data collected from the Coleman Mine proved that 20-30% energy savings could be achieved which exceeded original objectives.

Project Impacts:

- BESTECH's ventilation on demand technology resulted in GHG emission reductions of 483 t CO_2e/MW/year. Similar benefits are expected for further units.

Path to Market:

- NRG1-ECO aims to be the technology of choice for all Vale operations worldwide.
- BESTECH together with Xstrata is exploring further opportunities to commercialize NRG1-ECO.
- BESTECH currently in the process of selling and installing NRG1-ECO with the world leading mining companies in Canada and worldwide (i.e., Hoyle Pond, Musselwhite and Diavik Diamond Mine).
- At least eleven feasibility and engineering studies are underway globally.

Market Impact:

- Completed phase 1 and 2 installations at Rio Tinto's Diavik Diamond Mine. Commissioning of additional control strategies currently underway
- Expanded NRG1-ECO® system at Vale Coleman Mine beyond the 153 ore body and into the 170 ore body with mine-wide implementation planned for 2015/2016
- Obtained the Canadian Environmental Technology Verification (ETV) Program Certification from the Government of Canada.

Lakeshore EMPC Two L.P.

Round 16-2009B

Sector:
Waste Management

Project Completion Date
September 2012

Market Impact Report Due:
September 2014

Total Project Value:
$2,494,397

SDTC Funding:
$1,037,669

Leveraged Funding:
$1,456,728

Consortium Members:
Lakeshore EMPC Two L.P. (Lakeshore),
WNUF Lakeshore L.P. (WNUF),
EnviroMetal Technologies Inc.

Environmental Benefits:
(primary benefit bolded)
Clean Soil
Clean Water
Climate Change

Project Title:

First Full-Scale Application of ZVI-Clay Technology in Canada to a xVOC-Impacted Brownfield Property

Project Description:

Lakeshore EMPC Two L.P. ("Lakeshore") developed and demonstrated a project that used zero valent iron (ZVI) technology mixed with clay (ZVI-Clay) to facilitate the remediation of a 10.6-acre Brownfield property in Toronto with extensive chlorinated volatile organic compound (cVOC) contamination in both soil and ground water. ZVI-Clay is an innovative soil remediation technology that involves *in-situ* admixing of ZVI with stabilizing agents (clay) into cVOC-contaminated soils and groundwater. This mixing puts the cVOCs in contact with the surface of the ZVI where cVOCs are degraded through an abiotic process involving corrosion of zero-valent iron.

Objectives:

- To successfully remediate significant source cVOC contamination in soil and groundwater at a prominent Toronto industrial Brownfield in order to support the property's future redevelopment as a residential community in conformance with the City of Toronto's Official Plan.
- To demonstrate to the Canadian marketplace that ZVI-Clay technology is an effective and acceptable approach, from both technical and regulatory perspectives, to the remediation of Brownfield impacted by cVOC contamination and to demonstrate that it is the preferable approach to the existing alternatives, in particular Dig-and-Haul.

Results:

- ZVI-Clay technology commissioning and testing was completed at a 10.6 acre brownfield property in Toronto with extensive cVOC contamination in both soil (7,200 m^3 high impact soil and 21,412 m^3 low impact soil) and ground water
- Data collected from the Toronto demonstration project showed a 90% contaminant reduction (cVOC in soil), a reduction of 792 t CO_2e, 14,306 m^3 of landfill space saved, and 25,751 t aggregate (clean soils) saved per technology installation when compared to the baseline "Dig-and-Haul" scenario.
- Results from the demonstration project also showed reductions of emissions from SO_x, NO_x, particulate matter (PM), CO, and volatile organic compounds (VOCs).

Project Impacts:

- The ZVI-Clay technology is expected to result in an emission reduction intensity of 110 kg CO_2e/m^3 of high impact soil treated, or 792 t CO_2e/installation.
- The use of the ZVI-Clay technology is expected to result in cumulative GHG emission reductions of 59 kt CO_2e in Canada, by 2024 (based on a market rollout of 74 installations).

Path to Market:

- University of Colorado holds the core patent but did not file it outside the U.S., so it does not apply to Canada.
- ZVI is covered by two patents in Canada, both held by the University of Waterloo.
  - Initial ZVI patent - 2069621 filed 1990-11-28, which expired 2010-11-28.
  - Nickel-iron patent - 2235208 filed 1996-10-18, which expires 2016-10-18 (for nickel-plated ZVI, which can be used as a substitute for normal ZVI).
- Kilmer Brownfield Equity Fund L.P. (the parent company of Lakeshore EMPC Two) purchased a property in Montreal which was treated with ZVI-clay, amongst other remediation technologies. The remediation was approved by the Quebec Ministry of Environment in 2012 and is currently for sale with the intention of building 800 - 1,000 new residential condominiums.

Market Impact:

- Lakeshore canvassed several environmental consultants and ZVI producers who are aware of 6 new projects using ZVI technology in a similar context to remediate cVOC contamination to soil and ground water.

St-Jean Photochemicals Inc.

Round 11-2007A

Sector:
Energy Utilization

Project Delivery Completion:
September 2012

Market Impact Report Due:
September 2014

Total Project Value:
$4,902.456

SDTC Funding:
$1,506,082

Leveraged Funding:
$3,396,375

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 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.

Market Impact:

- The technology has not been commercialized due to the bankruptcy of Konarka, the partner for the industrialization and commercialization of the printed organic solar cells.

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 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 $\$100/m^2$ (including wiring).
- Demonstrate energy savings and CO_2e 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 $\$212/m^2$ 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 $CO_2e/m^2/yr$.
- Additional reductions in CAC emissions for the demonstration project were: 0.0581 kg NO_x/m^2/year; 0.0921 kg SO_x/m^2/yr; 0.0062 kg PM/m^2/yr.

Path to Market:

- 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. Technology improvements in the course of commercializing an automotive product will inform and contribute to the development of the architectural product in the future.

Market Impact:

- SWITCH Materials has made progress towards introducing its technology in the automotive market. In 2014 SWITCH delivered prototype parts to two automotive manufacturers for technology evaluation and has entered into a two-year joint development program with a manufacturing partner to support commercialization of the automotive product.
- SWITCH is working closely with an automotive manufacturer to commercialize an automotive glazing part for the 2018 model year through a new SDTC supported project.

Milligan Biofuels Inc. (formerly Milligan Bio-Tech Inc.)

Round 9-2006A

Sector:
Energy Exploration and Production

Project Delivery Completion:
October 2012

Market Impact Report Due:
October 2014

Total Project Value:
$28,141,614

SDTC Funding:
$7,004,493

Leveraged 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 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 emission reduction of 23,252 t CO_2e over its one year operating period. The emission reduction intensity associated with the demonstration was 3.66 kg CO_2e/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 expected 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.

Market Impact:

- In 2014, Milligan Biofuels produced 12.5 ML of biodiesel.
- Milligan Biofuels has created a valuable marketplace for damaged seed across Western Canada and beyond. The project benefits the local and surrounding communities, to rural Saskatchewan and Western Canada in terms of farming operations having a valued outlet for damaged seed, and to the families of the team members Milligan Biofuels employ.
- Due to the economic state of the biodiesel industry the plan for an additional facility to be under construction in 2015 is not a consideration at this time.

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 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 (pyrethoids, difenoconazole, fenoxaprop, and azoxystrobin) is expected to result in cumulative GHG emission reductions of approximately 8 kt CO_2e in Canada and 1.5 Mt CO_2e 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.

Market Impact:

- All crop protection products are strictly regulated and require government approval prior to product launch which could take up to two years after product demonstration.
- Due to the above factors, Vive plans to launch their insecticide in the US in 2015 and their fungicide and mixed product will likely launch in 2016. Canadian registrations are more involved and therefore product launch in Canada will lag the US.
- Vive has term sheet level distribution agreements with Amvac and United Suppliers and expect to convert those to full agreements before the end of 2015.

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 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 CO_2 in a conventional building to 20 t CO_2).

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.

Market Impact:

- As UBC CIRS was a demonstration of multiple approaches to building energy efficiency, the product is a series of recommendations and lessons learned that can be applied by building industry practitioners anywhere. These lessons are documented as part of the CIRS Technical Manual, Design Charrette and integrated design reports, case studies, articles, reports, videos, etc. which are posted on the CIRS website (www.cirs.ubc.ca). Thousands of people have joined tours of the facility and the CIRS team has delivered hundreds of presentations and keynote addresses to industry, NGOS, policy makers and regulators in North America, Europe and Asia.

Pathogen Detection Systems (Endetec)

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 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 the 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 the 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 CO_2e/m^3 water treated.
- CAC emission reduction intensities were determined as follows: 2.81E-09 t NO_x/m^3, 6.84E-10 t SO_2/m^3, 1.82E-10 t PM/m^3, and 3.2E-09 t CO/m^3.

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.

Market Impact:

- The sales organization has been tremendously successful in implementing the distribution channel strategy and Endetec currently has 32 distribution partners in 23 countries. The number of distribution partners is expected to continue to expand significantly over the next 24 months as the global strategy continues to be implemented.
- In 2012 and 2013 Endetec had placed a total of 70 units in 20 countries.

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 Title:

Mixed-Rigid Plastics Recovery Demonstration Facility

Project Description:

Canada generates an estimated 345,000 tonnes 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 ktCO_2e. The GHG emission reduction intensity associated with the demonstration was 2.07 tCO_2e 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 CO_2e in Canada and 9.3 Mt CO_2e 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 has expanded the capacity of its Sarnia RigidReclaim™ plant from its current capacity of 30 kt/yr in 2010 to 55 kt/yr in 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.

Market Impact:

- In its primary market, Ontario, Entropex's RigidReclaim project has led to an approximate 60% increase in the recovery of rigid plastics since 2009.

Integran Technologies Inc. (Morph)

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 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 100kW and 200kW 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.
- Integran also produced Nanovate™ aircraft engine components, 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- CO_2e in Canada and 387 kt- CO_2e 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- CO_2e in Canada and 22.5 kt- CO_2e 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 entre 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.

Market Impact:

- In consumer electronics, Integran has recently licensed the Nanovate™ technology to a major handheld device manufacturer and has transferred the technology into its supply chain in Asia. Production of millions of Nanovate™ NP device housings are planned to start in 2015 which will replace Mg die castings. The establishment of this licensee enables Integran with a cost effective supply chain to pursue other business and clients.
- Integran continues to innovate on the base technology developed in this program and has developed a metal coated polymer hybrid which is biocompatible and can be used for medical instruments. Integran is working with some of the world's largest medical device OEMs to bring this technology to market.
- Integran has maintained its AS9100 status for 3 consecutive years and has been supplying into the aircraft seating business with Nanovate™ NP and plans to grow this business. Aero engines remains a key focus area for development.

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:
$1,481,328

Leveraged Funding:
$2,983,194

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 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 CO_2e in Canada and 524 kt CO_2e in the rest of the world from 2013-2020.
- The roll-out is also expected to result in reductions in: Cr^{6+} released to the atmosphere and sewers, production of sludge containing Cr^{6+}, 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.

Market Impact:

- Integran has seen consistent growth in year over year commercial revenue over the past three years in this product area with a 17% increase from 2013 to 2014.
- In 2014, Integran received a material specification from the US Department of Defence for their product targeted to the areospace and defense industry.
- Integran is currently supplying 200MT annually of hard bar to the hydraulics cylinder industry from their manufacturing facility in Mississauga, ON.
- The hydraulic cylinder market represents an area of significant growth potential, with their partners targeting a market share in Europe of 20% within the next five years, using the Integran product to deliver cost savings of up to 40%.

Innoventé Inc.

Round 13-2008-A

Sector:
Waste Management

Project Completion Date
June 30, 2013*

Market Impact Report Due:
June 30, 2015

Total Project Value:
$5,908,755
(pending final audit)

SDTC Funding:
$2,730,526

Leveraged Funding:
$3,178,230

Consortium Members:
Institut de Recherche et de Développement en Agroenvironnement (IRDA)
F. Ménard Inc.
Kruger Inc.

Environmental Benefits:
(primary benefit bolded)
Clean Soil
Climate Change
Clean Water

*Project related activities were completed in June 2013 however final project reporting was completed in 2014.

Project Title:

SHOC™ (Séchage et Hygiénisation par Oxygation Contrôlée or Drying and Sanitization by Controlled Oxidation)

Project Description:

Innoventé Inc. and its consortium members have developed a technology and process for transforming organic residues like chicken and cattle manure, municipal wastewater treatment plant sewage, food processing wastes and pulp and paper mill sludges into a dried, bio-energy material called BEFOR (BioEnergy From Organic Residues). The project technological process is called SHOC™ (Séchage et Hygiénisation par Oxygation Contrôlée or Drying and Sanitization by Controlled Oxidation). The Innoventé process offers significant efficiency gains over conventional biomass production processes and requires very little external energy. The biomass produced via the SHOC™ process is used primarily for energy production. However, additional end-uses of the biomass product include the production of bio fertilizers, bio materials and pyrolysis feedstocks where higher nitrogen content may be favourable. In the demonstration project, the bio-drier receives an input feed of bio-solids, consisting mainly of chicken manure and cattle manure with an average solids content of 30-40%. In the bio-drying process, the feedstock is partially dried, sanitized and deodorized through an aerobic digestion process. An air compressor is used to constantly provide the bio-drier with air needed in the oxidation process, and an air bio-filtration process purifies the exhaust air before releasing it back into the atmosphere. The BEFOR product, with a solids content of 55%, is ready to be used in a cogeneration plant for the production of electricity and heat.

Objectives:

- To prove the technical feasibility of the new bio-dryer and establish operating parameters (i.e. energy requirements, throughput, temperature profiles, oxygen concentration, air flow, water content).
- To validate process energy requirements to ensure sufficient drying performance with a minimum amount of supplemental energy.
- To adapt the bio-dryer for manufacturing co-generation plant feed; and
- To evaluate the environmental impacts by life cycle analysis.

Results:

- The project resulted in the successful production of approximately 900 t of BEFOR product and demonstrated the feasibility of the Innoventé Inc. bio-dryer system with preliminary data collected on site, including emission analysis of the pilot unit and samples analyzed by an independent lab.
- The project was able to validate process energy requirements (e.g. diesel consumption from mixing and loading of raw feed and electricity consumption [kWh/t BEFOR] during the production process) based on the pilot unit operations.
- The bio-dryer was successfully adapted for manufacturing cogeneration plant feed in the form of BEFOR and laboratory analysis was conducted to determine the product energy content (MJ/kg) and solids content.
- The environmental impacts of the project and lifecycle assessment of the technology have been assessed via the development of a Sustainable Development Impacts Reporting System (SDIRS) Report.

Project Impacts:

- Innoventé Inc. will provide an innovative process for producing a biomass product for use in generating electricity and heat at a cogeneration facility in a sustainable manner.
- The project resulted in GHG emission reductions of 26.25 t CO_2e for an 8 month pilot demonstration project.
- 1,400 t of waste (manure and sludge) was used to produce 900 t of sanitized bio-combustible.
- Emerging practices and legislation are favouring landspreading applications of biosolids which lowers the risk of surplus phosphorus levels being applied through the use of agronomic-based best practices. Therefore, no water/soil benefits are attributed to Innoventé's displacement of biosolids from landspreading applications.

Path to Market:

- Despite the SHOC™ process having been successfully demonstrated, Innoventé unfortunately declared bankruptcy in December 2014. Sight line to commercialization is uncertain at this time.

Clariant (Canada) Inc. (formerly Phostech Lithium Inc.)

Round 16-2009B

Sector:
Transportation

Project Completion Date:
August 2013*

Market Impact Report Due:
August 2015

Total Project Value:
$16,911,055

SDTC Funding:
$4,700,508

Leveraged Funding:
$12,210,547

Consortium Members:
Phostech Lithium Inc.
Bathium Canada Inc.
K2 Energy

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

*Project related activities were completed in August 2013, however, final project reporting was completed in 2014.

Project Title:

Phostech Lithium P2

Project Description:

The automotive industry is investing in Lithium-Ion battery technologies for Hybrid Electric Vehicle (HEV) applications. Presently, the cathode material used in these batteries is a limiting factor in cell performance. While there are several lithium-ion cathode chemistries available, none adequately address thermal management and long operating cycle requirements necessary for use in electric vehicle batteries. Lithium Iron Phosphate (LFP) is presented as a viable option in cathode material used in these batteries. Clariant has created a high power density carbon nano-coated LFP cathode material that addresses the safety, cost and charge cycling issues for next generation electric car batteries. The project has focused on a 24 times scale-up from a 100 t/yr batch pilot plant to a continuous and fully integrated 2,400 t/yr plant; on producing a consistent quality material from a larger wet chemical processing unit, and on meeting battery manufacturers' specifications and price points.

Objectives:

- Validate the scale-up of a pilot plant with a capacity of 100 t/yr to a pre-commercial demonstration unit with a capacity of 2,400 t/yr.
- Achieve a production volume of stabilized and confirmed quality product, demonstrating its use by Clariant's partners/battery manufacturers, and an economic analysis of cost competitiveness.

Results:

- The pilot plant was successfully scaled up to the target output capacity with each step of the process exercised at the rated throughput. Yield and cost targets were met and exceeded through careful control of purity and material properties at the nanoscale. The EV battery manufacturers in the consortium confirmed that the material met their quality expectations.
- The high performance batteries were produced by the consortium. Extensive testing confirmed high energy density and excellent reliability. Bathium used some of these batteries in their Blue Car EV where driving range in excess of 200 km was achieved.

Project Impacts:

- GHG emission reductions during the demonstration phase are calculated as 163 kt CO_2e.
- It is estimated that the market rollout will lead to cumulative GHG emissions reductions of 21.8 Mt CO_2e in Canada and 30.5 Mt CO_2e in the rest of the World, for a total of 52.3 Mt CO_2e by 2024.
- GHG emission reduction intensities are 2.1 kt $CO_2e/tLiFePO_4$ in Canada and 1.7 kt $CO_2e/tLiFePO_4$ in the rest of the world calculated based on a 10-year battery life.
- The roll-out is also expected to result in total CAC emissions reductions of 51 kt NO_x, 21 kt SO_x, and 3 kt PM by 2024.

Path to Market:

- The process is ready for production at capacity today, in preparation for demand from battery manufacturers to produce LiFePO4.

Nutra Canada

Round 15-2009A

Sector:
Waste Management

Project Completion Date:
September 2013*

Market Impact Report Due:
September 2015

Total Project Value:
$9,462,146

SDTC Funding:
$1,900,000

Leveraged Funding:
$7,562,146

Consortium Members:
Nutra Canada
Onipro
Vert-Nature
Atrium-Innovation
Fruit d'Or

Environmental Benefits:
(primary benefits bolded)
Clean Soil
Climate Change
Clean Water

*Project related activities were completed in September 2013, however, final project reporting was completed in 2014.

Project Title:

Demonstration of an innovative and efficient extraction process for the production of high quality fruit and vegetable extracts.

Project Description:

In Canada, up to 50% of fruits and vegetables produced are wasted at various stages of production, harvesting, transport and storage. A significant portion of these fruits and vegetables currently end up in landfills. Meanwhile, the multi-billion dollar functional food and health food market relies on expensive extraction processes for nutrients and requires Grade 1 fruits and vegetables grown in premium soil conditions. Nutra Canada has demonstrated an economically and environmentally superior nutrient extraction process to serve the growing global functional food market using fruit and vegetable residues rather than whole fruit thus providing better margins than conventional approaches due to lower feedstock and energy costs. The process also allows better preservation of active ingredients than competing technologies. By avoiding the use of land to grow fruits and vegetables strictly for the production of functional and health food, Nutra Canada improves the yield of prime quality soils and conserves water that would otherwise be needed for irrigation.

Objectives:

- Demonstrate the Nutra Canada extraction process by producing high quality fruit and vegetable extracts from 4,000 t of residue.
- Demonstrate the energy efficiency of the Nutra Canada drying process compared with conventional drying processes (3-5 times more energy efficient).
- Demonstrate that the Nutra Canada extraction process yields high quality extracts while using Grade 2 fruits and vegetables as feedstock.

Results:

- Processed 600 t of fruit and vegetable residue.
- Demonstrated that the drying process was 5.5 times more energy efficient than the conventional drying process.
- The Nutra Canada demonstration project yielded 10 t of high quality extracts using Grade 2 fruits and vegetables as feedstock.

Project Impacts:

- The project resulted in the optimization and demonstration of Nutra's high efficiency drying process, and of the facility as a whole to produce high quality fruit and vegetable extracts from Grade 2 feedstock.
- The demonstration project (600 t of residue processed) reduced GHG emissions by 33 t CO_2e/yr while processing 4,000 t of residue would reduce GHG emissions by 169 t CO_2e/yr.
- The project also resulted in reduced nitrates, phosphates, pesticides being released to soil and water, as well as water conservation.

Path to Market:

- Nutra Canada's mission is to provide quality ingredients to the growing nutrition market in Canada and Internationally. Their technology enables the production of highly concentrated products for lesser costs than conventional technologies.
- In the next 10 years, Nutra Canada plans to expand the production capacity of their current facility, in Champlain, Quebec, by up to five times. Nutra Canada also plans to establish other production facilities in four locations in Canada and seven locations abroad, including: Ontario, British-Columbia, the United Sates and in Europe. New facilities will be built near sources of renewable energy and in areas where vegetables and fruits are produced.

FuseForward International Inc.

Round 11-2007A

Sector:
Energy Utilization

Project Delivery Completion:
October 1, 2013*

Market Impact Report Due:
N/A

Total Project Value:
$1,523,921

SDTC Funding:
$400,000 (pending final audit)

Leveraged Funding:
$1,123,921

Consortium Members:
Utilities Kingston
Hatch Mott MacDonald

Environmental Benefits:
(primary benefit bolded)
Clean Air
Clean Water

*Project related activities were completed in October 2013, however, final project reporting was completed in 2014.

Project Title:

Sustainable Utility Infrastructure

Project Description:

This demonstration project consisted of implementing FuseForward's Infrastructure Asset Intelligence (IAI) software into the water and wastewater operations of Utilities Kingston in Kingston, Ontario. This technology was intended to enable accurate monitoring detection analysis and anticipation of issues such as waste water overflows, water leakage and water supply interruption from water main breaks.

Objectives:

- Scale the IAI technology for a multi-system utility (water and wastewater).
- Provide reusable system models for the utility.
- Validate the simulation and performance indicator calculation system.
- Demonstrate the tools for complex utility infrastructure management.

Results:

- The technology was scaled for the City of Kingston's water and wastewater services.
- Fuseforward's analytics technology was able to be configured to capture and analyze large sets of streaming data from meters and sensors.
- The planned testing did not end up taking place as a result of changing priorities at Utilities Kingston.
- FuseForward was able to obtain academic validation for the IAI technology.

Project Impacts:

- Project environmental impacts could not be calculated since the technology was not tested and validated by Utilities Kingston.

Path to Market:

- During the course of the SDTC project, Fuseforward realized that apart from the municipal water industry, there are additional markets where software-based asset management programs could conceivably provide customers with a tangible value proposition.
- These markets, accessed either directly or through the use of channel partners, include facilities management, industrial monitoring, agriculture and municipal utilities where the technology will be marketed for both energy and water reduction benefits.

Nexterra Systems Corp.

Round 13-2008A

Sector:
Forestry, Wood Products and Pulp & Paper Products

Project Delivery Completion:
October 2013*

Market Impact Report Due:
October 2015

Total Project Value:
$20,263,664

SDTC Funding:
$5,518,777

Leveraged Funding:
$14,744,887

Consortium Members:
Nexterra Systems Corp.
General Electric Energy
University of British Columbia

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

*Project related activities were completed in October 2013, however, final project reporting was completed in 2014.

Project Title:

Advanced Power Biomass Gasification Demonstration Project

Project Description:

Nexterra Systems Corp. (Nexterra) has developed and tested a synthesis gas (syngas) cleaning process for that can be paired with its commercial biomass gasification platform. The cleaned syngas can be used in internal combustion engines (ICEs) for renewable combined heat and power (CHP) systems or as a feedstock for renewable gases or chemicals. Syngas, derived from biomass, typically has a suitable heating value and composition for combustion in internal combustion engines (ICEs), but the gas contains impurities (tars, ash, etc.) that, over time, cause damage to ICEs, reducing their efficiency and lifetime. Nexterra's process removes these impurities, allowing for the combustion of clean biomass-derived syngas be used within ICEs for CHP or other applications. This results in GHG and air pollutant (CAC) emissions reductions in comparison with the conventional practice of combusting fossil fuels. The use of waste biomass as a fuel results in additional GHG reductions through the avoidance of methane generation in landfills.

Objectives:

- Design, build, commission, and start-up a pilot scale syngas conditioning process combined with a 250 kWe ICE at Nexterra's pilot plant facility in Kamloops, BC. Complete system endurance testing for 900 hours.
- Produce syngas that meets fuel quality specifications for ICEs. Requirements include sufficient heating value, composition, stability, and combustion properties suitable for controlled and rapid combustion.
- Design, construct and commission a commercial-scale demonstration facility at the University of British Columbia (UBC). Produce clean syngas for a 2 MWe ICE and provide steam and electricity to UBC's internal energy system.
- Demonstrate the process for a minimum uninterrupted period of 600 hours in CHP mode.

Results:

- The start-up of the pilot scale conditioning and 250 kW ICE system at Nexterra's pilot plant facility in Kamloops, BC was successfully completed. Nexterra achieved approximately 5,000 hours of runtime on the syngas conditioning unit and 3,000 hours on the ICE.
- The quality of the syngas produced was in full compliance with fuel specifications for ICEs.
- The commercial-scale demonstration facility was successfully commissioned and tested at UBC. The facility operated for approximately 226 hours in CHP mode and has operated more than 15,000 hours in thermal mode (since 2012).
- Issues with the heat exchanger system prevented the commercial-scale facility from meeting the objective of 600 uninterrupted hours in CHP mode. Options are under consideration to replace the heat exchanger in order to resume CHP operation. In the meantime the engine is operating on renewable natural gas.

Project Impacts:

- The demonstration of Nexterra's system at UBC resulted in GHG emissions reductions of approximately 11 kt CO_2e, or 5.4 kt CO_2e per MWe installed CHP system capacity.
- Demonstration CAC emissions were measured and found to be below levels set by air quality regulations.
- The roll-out of Nexterra's technology is expected to result in GHG emissions reductions of approximately 240 kt CO_2e in Canada and 335 kt CO_2e in the rest of the world, over the period 2014-2022.
- The roll-out of Nexterra's system is also expected to result in clean air benefits.

Path to Market:

- The UBC facility was a key reference site for Nexterra's UK partners conducting technical due diligence on its commercial technology. This resulted in Nexterra's first UK contract (Dec 2013).
- Nexterra and UBC are looking for an industrial partner to aid in testing for commercial replication of the syngas conditioning application.

GaN Systems Inc.

Round 12-2007B

Sector:
Energy Utilization

Project Completion Date
November 2013*

Market Impact Report Due
November 2015

Total Project Value:
$5,804,880

SDTC Funding:
$1,500,000

Leveraged Funding:
$4,304,880

Consortium Members:
GaN Systems Inc.
Arkansas Power Electronic International Inc.

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

*Project related activities were completed in November 2013 however, final project reporting was completed in 2014.

Project Title:

High Efficiency GaN Systems for Transportation

Project Description:

GaN Systems Inc. was developing an innovative gallium nitride transistor technology on a silicon carbide substrate ("GaN-on-SiC") for applications with high power and high efficiency requirements such as hybrid and electric vehicles (HEVs and EVs). Gallium nitride technology offers significant efficiency improvements over traditional silicon technology when used in high power conversion systems, thereby reducing greenhouse gas (GHG) emissions and various criteria air contaminants (CAC). This project involved the design and fabrication of GaN transistors, which were assembled by their consortium partner, Arkansas Power Electronic International (APEI), in rugged high-performance packages for eventual integration into an HEV.

Objectives:

- Develop a 15A, 600V transistor using gallium nitride technology for use in HEV applications.
- Develop a highly reliable, economic, robust 2kW DC-DC converter (600V to 12V) using these transistors.
- Demonstrate that the DC-DC converter meets the objectives of HEV car makers who are seeking to eliminate the use of 12V lead-acid batteries for on-board auxiliary systems.

Results:

- The project resulted in the design and fabrication of GaN based power transistors, in both 400V and 650V configurations, which fully meet the performance requirements for use in automotive applications.
- These transistors were used in the design of a high efficiency 2kW DC-DC boost converter capable of reliably handling voltages of up to 650V as required for use in HEVs.
- Representative boost converters were assembled and tested by APEI. Conversion efficiencies in excess of 98% were measured under loads ranging up to 3.5kW, demonstrating the competitive advantage of the gallium nitride technology over traditional approaches where conversion efficiencies of 85-90% are considered typical.

Project Impacts:

- GaN Systems Inc. will provide a competitive DC-DC converter system for integration into HEVs, thereby increasing efficiency and reducing GHG and CAC emissions resulting from HEV use.
- The project resulted in GHG emission reductions of 0.37 t CO_2e/yr/installation; or reductions of 14.2% compared to the baseline condition.
- Further, the technology could result in CAC reductions of the following amounts on a per year, per installation basis: SO_x reductions of 14.5% (0.36 kg); NO_x reductions of 14.2% (0.56 kg); PM reductions of 17.7% (0.06 kg); and CO reductions of 13.7% (14.79 kg).

Path to Market:

- GaN Systems has subsequently started to sell its components to power systems makers and has established worldwide marketing/support offices and distribution channels. The company's customers are integrating GaN Systems transistors into their products, which include electric vehicle battery chargers, solar (PV) systems, power supplies for appliances, TVs and many other high efficiency power conversion applications.
- The company has now successfully transitioned its technology from the silicon carbide substrate ("GaN-on-SiC") to a silicon substrate ("GaN-on-Silicon"), which has provided a many-fold cost reduction. This enables the products to compete in mainstream high volume markets and to gain market share against incumbents who use conventional technology.
- GaN Systems and APEI continue to work together to advance gallium nitride technology for use in motor drive inverters for hybrid and electric vehicles. This includes an ongoing development with Toyota, sponsored by the US Department of Energy, for a new generation of highly efficient inverters for HEV motor drives.

Produits Enuchem Inc. (formerly Deane & Co Inc.)

Round 14-2008-B

Sector:
Energy Utilization

Project Delivery Completion:
December 2013*

Market Impact Report Due:
December 2015

Total Project Value:
$1,499,904

SDTC Funding:
$595,000

Leveraged Funding:
$904,904

Consortium Members:
Produits Enuchem Inc.
Enutech Inc.
Université du Québec à Montréal
Les Forages Liégeois Inc.

Environmental Benefits:
(primary benefit bolded)
Clean Soil
Clean Water
Climate Change

*Project related activities were completed in December 2013 however, final project reporting was completed in 2014.

Project Title:

EnuBioDechlor XL™ - Remediation solvent for chlorinated solvent contaminated sites

Project Description:

Produits Enuchem Inc. (Enuchem) and members of its consortium developed a technology called "EnuBioDechlor XL™" for the remediation of chlorinated solvent contaminations. EnuBioDechlor XL™ is a liquid that consists of emulsified saponified soybean oil with iron powder. It degrades chlorinated solvents and intensifies the biological activity of bacteria capable of biodegrading chlorinated solvent contaminants. Two of the main contaminants targeted by this technology are toxic substances known as perchloroethylene (PCE) and trichloroethylene (TCE). Bacteria and EnuBioDechlor XL™ are injected in-situ and together convert chlorinated solvents in subsurface environments into ethylene (C_2H_4), a non-toxic gas, and harmless chloride ions.

EnuBioDechlor XL™ minimizes the disturbance of treated lands and can also be used on occupied lands and under buildings. EnuBioDechlor XL™ helps reduce emissions of greenhouse gases (GHGs) by treating contaminated soils in situ, avoiding the use of diesel-powered heavy equipment normally used for excavation. This technology intends to reduce remediation costs compared to the current methods, while increasing the number of sites where decontamination is feasible. The project demonstrated application of the technology in five contaminated sites consisting of one chemical industry company and four dry cleaning facilities.

Objectives:

- In-situ full remediation of soils and groundwater contaminated with chlorinated solvents (PCE and TCE) without excavation or landfill and requiring minimal energy consumption.
- Development of a technique to confine contaminated areas (principle of permeable reactive barrier) and to gradually decrease the contamination size.

Results:

- EnuBioDechlor XL™ is suited for Chlorinated Aliphatic Hydrocarbon (CAH) contaminated groundwater and small to average CAH soil contaminations in saturated or semi-saturated environments. EnuBioDechlor XL™ was injected in all sites without excavation or land filling. A first and second site in St. Constant and St. Henry were completely remediated during the project. A third and fourth site in Bedford and St. Jean, were partially remediated because the duration of the project was not sufficient to show complete remediation. Treatment is continuing even after completion of the project.
- A fifth site in St. Sauveur successfully demonstrated the technology as a permeable reactive barrier, avoiding the contamination of downstream groundwater.

Project Impacts:

- The demonstration of Enuchem's technology resulted in PCE reductions of 8 kg/yr in soil.
- The release of PCE and TCE in water were measured and emission reductions reached 162 kg/yr for PCE and 85 kg/yr for TCE during the demonstration.
- The demonstration also resulted in GHG emission reductions of 27.4 t/yr of CO_2e.
- The roll-out of Enuchem's technology is expected to result in PCE reductions in soil of 1,079 kg, release reductions of 31,590 kg of PCE and 16,575 kg of TCE in water and 2.1 kt of CO_2e over the period 2014-2028.

Path to Market:

- With the successful demonstration of the technology, the total number of sites treated is expected to increase from 5 in 2014 to 390 in 2028.

Verdant Power Canada ULC

Round 12-2007B

Sector:
Power Generation

Project Delivery Completion:
December 2013*

Market Impact Report Due:
December 2015

Total Project Value:
$1,200,346

SDTC Funding:
$487,324

Leveraged Funding:
$713,022

Consortium Members:
Verdant Power, Inc.,
St. Lawrence College
of Applied Arts
and Technology

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

*Project related activities were completed in December 2013 however, final project reporting was completed in 2014.

Project Title:

The Cornwall Ontario River Energy (CORE) Project – Phase 1

Project Description:

Verdant Power Canada (VPC) initiated a demonstration of a novel River Kinetic Hydropower System (KHPS) which employs arrays of underwater turbines to generate renewable electricity from large, continuously flowing river systems without the need to divert or impound any part of the river's natural flow. This continuous energy source makes the technology an effective complement to base load power, enhancing commercial viability and potential for replication from major urban areas to remote villages near river systems. The project was conducted in the St. Lawrence River near Cornwall, Ontario.

Objectives:

- Develop a methodology and conduct an accurate resource assessment. This data is essential to the design and location of the turbines for maximum output and economic performance.
- Obtain all regulatory permits required for the various phases of deployment under the Canadian Environmental Assessment process.
- Design and deploy a riverbed mounting system including a protocol for deployment/retrieval and eventual maintenance of the CORE Project.
- Optimize the design of Verdant's Gen5 turbine for superior performance in a river.

Results:

- VPC completed an in-depth resource assessment complete with diver-collected video mapping and sediment samples, boat-mounted sonar bathymetry data and an archeological site assessment.
- A complete fish and fish habitat assessment was completed and submitted to the regulatory authorities. An Environmental Assessment was required and involved a stage-gated permitting process for each phase of deployment during the Project. The first permit was to deploy a tripod-mounted Acoustic Doppler Current Profiler (ADCP) and video camera. Verdant received their first permit in 2009 and a second permit in 2011.
- Stamped designs for a multi-turbine gravity base and lift frame were completed.
- Between the data sets, sufficient information was collected to complete the design of the turbine mounting system but due to the state of the financial markets in 2009/10 and subsequent lack of financial resources, the Project was put on hold and no further results were achieved.

Project Impacts:

- The demonstration of the river turbines did not take place and therefore there were no environmental benefits associated with the demonstration project.

Path to Market:

- Verdant continues to develop their FERC-licensed site in the East River, NY and intends to develop an Ontario-based site building on the resource assessment methodology, foundation design and deployment/retrieval strategies developed under this Project.

Corporation HET/LactoScience Inc. (LSI)*

Round 11-2007A

Sector:
Waste Management

Project Completion Date:
December 2013*

Market Impact Report Due:
December 2015

Total Project Value:
$6,441,396

SDTC Funding:
$1,509,807

Leveraged Funding:
$4,931,589

Consortium Members:
Corporation HET/
LactoScience Inc.
Fromagerie Perron
NUTRECO Canada
Agresearch

Environmental Benefits:
(primary benefit bolded)
Clean Water
Climate Change
Clean Soil

*Project related activities were completed in December 2013, however, final project reporting was completed in 2014.

Project Title:

Demonstration Project for the Valorization of Whey from the Cheese Industry

Project Description:

Corporation HET/ LactoScience Inc. (HET/LSI) has developed and demonstrated a novel treatment process to address residual whey from cheese and Greek yogurt production and convert it to a valuable Base-L yeast product. The process provides an alternative whey disposal option to existing restrictive land and sewer disposal options that limit the operation and expansion of small and medium-sized cheese factories and the growth of the Greek yogurt production. The yeast product could be used as a protein source for animal and human nutrition, and be used in pharmaceutical and industrial applications.

Objectives:

- Demonstrate the fermentation system at pilot scale for treating whey and milk sub-products' effluents from a cheese factory.
- Demonstrate the autonomy of the process through the use of generated heat from the process to dry the final product.
- Demonstrate the benefits of Base-L as a blood plasma substitute through animal feed trials.
- Demonstrate the decreased use of preventive antibiotics in piglet feed through long term animal feed trials.

Results:

- HET/LSI achieved plant production of 4m^3 per hour for 14 and 15 hour runs, and consistent production of Base-L was completed with 40-43% protein content. With additional optimization, HET/LSI has been able to achieve over 18kg of product per ton of whey.
- It was determined that the temperature of the residual heat from the process was insufficient for economical recovery and usage for drying.
- Animal feed trials indicated that Base-L can be a direct replacement for Dried Blood Plasma (DBP) in animal feed at cost competitive rates, therefore providing a slight switching incentive in addition to not using an animal-based product in the feed.
- A test protocol was designed to review suitability for Base-L to be applied in veal nutrition, however long-term studies have not been completed.
- Additional optimization of the process has resulted in demonstrating the unique ability to process 'acid' whey from Greek yogurt producers, as other treatment methods are ineffective at managing low pH whey streams.

Project Impacts:

- While initial whey treatment runs were completed during this Project, the water treatment system was not installed and hence, there were no material project benefits.

Path to Market:

- HET/LSI has indicated that approximately 150 billion litres of whey are generated annually worldwide, of which approximately 50% remains untreated. This represents a global potential market value of $1.4B. In North America alone, 48 billion litres of whey are produced, representing $430M in potential revenue; Canadian cheese producers generate 3.5 billion litres annually for a potential market of $32M.
- HET/LSI has partnered with Alfa Laval for technology commercialization. This Swedish-based global engineering company specializes in products and engineered solutions with a dedicated focus on the food industry and the global challenge of sufficient protein, and provides a clear path to potential market adopters of the LSI process.
- Initial target rollout will be to Greek yogurt producers due to its rapidly growing market demand and limited alternative whey treatment options available.

**LactoScience Inc. (LSI) was created in 2012 for this project to be continued and completed as originally planned by Corporation HET in 2010.*

Ballard Power Systems Inc.

Round 15-2009A

Sector:
Transportation

Project Delivery Completion:
December 2013*

Market Impact Report Due:
December 2015

Total Project Value:
$32,452,471

SDTC Funding:
$6,905,887

Leveraged Funding:
$25,546,584

Consortium Members:
Ballard Power Systems Inc.
BC Transit

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

*Project related activities were completed in December 2013, however final project reporting was received in 2014.

Project Title:

Fuel Cell Module and Electric Drive Development Program

Project Description:

Ballard Power Systems is facilitating the commercialization of fuel cell hybrid buses through the development of critical new technology for the hybrid power train. Ballard designed, assembled, and tested key sub-components for the fuel cell module and hybrid electric drive aimed at reducing vehicle cost, improving both the durability of select sub-systems, and the overall performance of the bus. These design changes were implemented on twenty service buses operated by BC Transit and fuelled using hydrogen obtained by electrolysis powered by the 98% hydroelectric grid in Quebec, Canada and from Chlor-Alkali waste hydrogen.

Objectives:

- Improve the performance from 8 km to 10 km per diesel gallon equivalent (dge).
- Increase warranty provision of over 10,000 hrs, compared to 6,000 – 8,000 hrs for the current Generation 6 (HD6) module.
- Improve operating cost from $1.20/mile to $0.85/mile.
- Develop an HD7 module with a lifetime of 20,000 hours and a capital cost of less than $1 million per bus in commercial volumes.

Results:

- Ballard exceeded the fuel economy goal of 10 km/dge (15 km/dge) with the SunLine Transit Bus.
- Ballard is introducing Generation 7 (HD7) to the market at the end of 2014, and is offering a 15,000 hour warranty, based on a combination of actual field performance and accelerated durability testing.
- Operating costs of at least $0.85 per mile has been achieved.
- During the demonstration period, a 20,000 hour module lifetime was not achieved. Operation in the field will allow Ballard to confirm the noted target. The $600,000 bus price is achievable with HD7, as validated by New Flyer and Van Hool bus OEM's.

Project Impacts:

- GHG emission reductions during the demonstration phase were 2 ktCO_2e.
- It is estimated that the market rollout will lead to cumulative GHG emissions reductions of 79 kt CO_2e in Canada and 1.2 Mt CO_2e in the rest of the World, for a total of 1.3 Mt CO_2e by 2024.
- GHG emission reduction intensities are 45.5 t CO_2e/bus/yr in Canada and 45.3 t CO_2e/bus/yr in the rest of the world calculated based on a 10-year battery life.
- A roll-out based upon Steam Methane Reformation (the most common form of hydrogen production today) is expected to result in total increase in CAC emissions of 3.1 kt NO_x, 2.3 kt SO_x, and 0.5 kt PM by 2024, mostly due to the production of natural gas. For a roll-out that utilizes electrolysis of water to generate hydrogen, as is the case for the Whistler project, CAC reductions of 2.41 kt NO_x, 1.66 kt SO_x, and 0.13 kt PM by 2024 are expected.

Path to Market:

- Ballard is currently selling the FCvelocity-HD6 module into the full size transit bus market in Western Europe, North America, China and India. Ballard is committed to growing this business with the HD7 as the market for fuel cell buses expands. Ballard is also leveraging the technology for adjacent markets such as passenger ferries, locomotives and aerospace.

Morgan Solar Inc.

Round 15-2009A

Sector:
Power Generation

Project Completion Date:
March 2014

Market Impact Report Due:
N/A

Total Project Value:
$9,299,472
(pending final audit)

SDTC Funding:
$2,351,580

Leveraged Funding:
$6,947,892

Consortium Members:
University of Ottawa

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

Project Title:

High Concentration Photovoltaic Solar Panels

Project Description:

High Concentrating Photovoltaic (CPV) is recognized as being a substantially more efficient way to collect solar energy in comparison to conventional photovoltaic (PV) approaches. To date, virtually all CPV companies concentrate the sunlight using bulky and expensive optics such as Fresnel lenses or curved mirrors. As a result, CPV systems have struggled to compete with PV systems on installed cost ($/W and $/kWh). Morgan Solar has developed a patented Light-Guide Solar Optic (LSO) technology which concentrates solar energy in a fraction of the volume of competing CPV solutions. The use of thin, lightweight, and fully sealed acrylic optics enables system wide cost reductions. A 50% reduction in $/W of installed costs can potentially shorten the economic payback period for large-scale solar farms by several years.

Objectives:

- Set up of a semi-automated pilot production line capable of achieving competitive costs.
- Optimization of the manufacturing process through the use of detailed simulations and sensitivity analysis.
- Demonstration of field efficiencies greater than 17% and compliance with industry reliability testing standards.
- Characterization of a statistically relevant sample of panels in operation.

Results:

- Initial project achieved significant progress towards the industry goal of <$1/W.
- A detailed understanding of the sensitivity of product performance upon process tolerances and manufacturing defect levels led to design changes. This increases the confidence that the next generation product will meet its goals.
- Demonstrated field efficiencies exceeded initial objectives. Typical degradation rates were low as per industry standards.
- On-going monitoring of the panels installed at the demo sites in Toronto, University of Ottawa and Littlerock, California has provided valuable field data to accelerate the development of a new product.

Project Impacts:

- The technology is being further developed. The LSO technology is being incorporated into future product designs, and as such will not be rolled out to the market. Market roll-out environmental benefits have not been calculated.

Path to Market:

- Morgan Solar has continued development of the technology in a follow-on project and will commercialize a future generation product that has already demonstrated over 28% efficiencies and is expected to realize a competitively lower installed cost.

dPoint Technologies Inc.

Round 13-2008A

Sector:
Energy Utilization

Project Delivery Completion:
June 2014

Market Impact Report Due:
June 2016

Total Project Value:
$3,582,961
(pending final audit)

SDTC Funding:
$1,531,394

Leveraged Funding:
$2,051,568

Consortium Members:
Ecologix Heating Technologies*
Windmill Development Group*
Tridel Corp.

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

*Not active after Milestone 1

Project Title:

Energy Recovery Ventilator Core Field Trial

Project Description:

dPoint Technologies Inc. demonstrated a low cost, high performance polymer membrane used to recover sensible (heat) and latent (moisture) energy in residential and small commercial units. Building on its previous work developing heat and humidity exchangers for the fuel cell industry, dPoint has produced an Energy Recovery Ventilator (ERV) "cartridge" using a patented pleating technique. With a total effectiveness of up to 65% (using a counter cross flow core) for both cooling and heating, it will add another 10% in building energy savings while increasing the quality of the air, and will not freeze in winter like current ERV's. This three-year project focused on improving smaller decentralized Heating, Ventilating and Air Conditioning (HVAC) systems at low and medium ventilation rates and measured heating and cooling load reduction.

Objectives:

- Illustrate the amount of energy that can be saved through the utilization of dPoint's high effectiveness ERV Core in a residential application versus the use of no energy recovery products.
- Measure and compare, under different climatic conditions, the energy used by residential suites employing in-suite Integrated Fan Coil Units (IVFCs) with ERV cores to suites not employing IVFCs through modeling performed by Provident Energy Management Inc.
- Demonstrate and measure the difference in performance and energy savings using a dPoint next generation counter-flow ERV core versus a traditional dPoint cross-flow ERV core design.

Results:

- ERV cores were installed in four suites in Tridel's Accolade residential condominium. Two of the suites were fitted with standard Heat Recovery Ventilator (HRV) cores and two were fitted with dPoint's advanced polymer ERV cores. All four demonstrated substantial energy savings (60-82%) with respect to the baseline of no heat recovery. The ERV cores performed better (75-82%) than the standard HRV core units (60%). These results were in-line with expectations and led to the decision to move forward with further demonstrations.
- Field monitoring and energy modeling of dPoint ERV/IFCU units in comparison with HRV/IVFCs and corridor pressurization systems during a winter testing period were conducted. An energy model of the Ventus Tower (Scarborough, ON) was developed for two scenarios, HRV/IFCUs vs. ERV/IFCUs and ERV/IFCUs vs. corridor pressurization. The results illustrated:
  - There is no discernible performance difference between HRVs and ERVs with respect to whole building energy recovery. Analysis of the sensible and latent recovery rates for a typical building zone indicated that latent capacity comprises a relatively small portion of the overall total energy recovery when an ERV system is used.
  - Considering all energy end uses, the use of ERV/IFCUs results in a total annual energy consumption reduction of 12.6% compared to the use of a corridor pressurization system.
- 615 suites were installed with ERV cores in the two Ventus towers, most were cross-flow ERV cores, with two being dPoint next generation counter-flow cores. The counterflow cores were shown to be generally more effective with respect to sensible and latent heat recovery than cross-flow cores.

Project Impacts:

- GHG emission reductions result from reduced energy consumption for heating (natural gas) and cooling (electricity) using the ERV/IFCU system vs. direct ventilation with no heat recovery.
- GHG emissions reductions for the whole building ERV/IFCU scenario were calculated to be 0.33 t/CO_2e/unit/yr.
- With the exception of SO_x (which increased 0.11 kg/unit/yr on a lifecycle basis), the ERV/IFCU systems also resulted in reductions in CAC emissions. CAC emission reductions for the whole building ERV/IFCU scenario were calculated as follows: NO_x decreased 0.37 kg/unit/yr; PM decreased 0.01 kg/unit/yr; CO decreased 0.13 kg/unit/yr; and VOC decreased 0.04 kg/unit/yr.

Path to Market:

- With the successful demonstration of the technology, the total number of Canadian installations is projected to increase from 5 in 2010 to 70,000 in 2024.
- Assuming successful application in the rest of the world, the installations outside of Canada would begin in 2015 with 20,000 and the total number of installations would increase to 2,640,000 in 2024.
- GHG emission reductions for installations are projected to be 24 kt CO_2e/yr in Canada and 1.1 Mt CO_2e/yr in the rest of the world by 2024.

Lignol Innovations Ltd.

Round 14-2008B

Sector:
Forestry, Wood Products, and Pulp and Paper Products

Project Delivery Completion:
June 30, 2014

Market Impact Report Due:
June 30 2016

Total Project Value:
$18,637,607

SDTC Funding:
$6,370,076

Leveraged Funding:
$12,267,531

Consortium Members:
Lignol Innovations Corp.
S2G Biochemicals Inc.
HA International LLC

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

Project Title:

Generation 2.1 Biorefinery Technology

Project Description:

The successful commercialization of next-generation biofuels will be enhanced by the development of bio-refineries with the ability to generate multiple co-products and handle diverse feedstocks, including agricultural residues and long dead, beetle killed, Lodgepole pine (BKLP). Lignol Innovations developed and demonstrated new innovative technologies that made greater utilization of the hemicellulose derived sugars by converting these to an additional yield of ethanol and other sugar platform chemicals such as glycols. The project also demonstrated higher value applications for lignin including usage in various high quality resin blends and thermoplastics.

Objectives:

- Greater utilization of the biomass-derived sugars, by conversion to improved yield of ethanol and other sugar platform chemicals such as glycols, to increase revenue and profitability.
- Utilization of long dead, non-merchantable BKLP in BC and Alberta as biorefinery feedstock to enable GHG reductions compared with allowing the wood to decay.
- Demonstration of higher value applications for the extracted lignin commercially known as HP-L™ (i.e., substitute ingredient for various resin blends, thermoplastics, carbon fibre, etc.).
- Extraction of hemicellulose sugars from the biomass prior to fractionation to recover a two-fold increase of usable sugars for subsequent conversion to cellulosic ethanol and/or other biochemicals.

Results:

- The pilot plant was operated for approximately 670 days, producing 45,400 L of ethanol.
- Lignol tested BKLP from four regions of BC, ranging in age from 3-8 years (time since death). Despite the variability, all samples responded similarly and acceptably to the bio-refinery process.
- Lignol developed relationships with more than 12 different lignin and hemi-cellulose product end-users all having tested samples of Lignol's product line in their commercial processes. HP-L™ is suitable for use as a precursor to carbon fibre, an adhesive for oriented strand board, to displace polyurethane in foam insulation and industrial coatings, among many others.
- Lignol's HP-L™ lignin was shown to achieve acceptable dispersion and performance characteristics in quantities of up to 50% when prepared in a copolymer polypropylene for thermoplastic applications.

Project Impacts:

- The operation of Lignol's pilot plant resulted in GHG emissions reductions of approximately 107 t CO_2e, or 0.83 t CO_2e/t wood feedstock.
- The roll-out of Lignol's technology could result in GHG emissions reductions of approximately 28 Mt CO_2e in Canada and 25 Mt CO_2e in the rest of the world, over the period 2014-2023.

Path to Market:

- Fibria Innovations Inc. acquired the assets of Lignol Innovations in January 2015. Fibria Innovations Inc. is a newly formed subsidiary of Fibria Celulose S.A., a Brazilian company and the world's largest market pulp producer and global leader in the production of Eucalyptus pulp. Fibria Celulose will incorporate Fibria Innovation's expertise to develop lignin related technologies and applications.

Pulse Energy Inc.

Round 15-2009A

Sector:
Energy Utilization

Project Delivery Completion:
July 2014

Market Impact Report Due:
July 2016

Total Project Value:
$8,552,915
(pending final audit)

SDTC Funding:
$2,556,801

Leveraged Funding:
$5,996,114

Consortium Members:
B.C. Hydro
Grouse Mountain Resorts
University of British Columbia
Village of Hartley Bay
Cisco Systems Canada Co.

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

Project Title:

Energy Management System Development and Implementation

Project Description:

Emerging climate change regulations, volatile energy prices, peak electricity shortages and the evolution of the smart grid are driving the need in Canada and abroad for improved management of energy use in buildings and communities. Pulse Energy developed an intelligent energy management platform called Pulse™ that can provide building owners and utilities with accurate and user friendly building energy and resource consumption information. This data can highlight inefficiencies in real time and enable operators to identify and correct the source of the problem, resulting in annual energy savings of up to 25%. Working with its consortium partners, Pulse Energy developed and demonstrated the second generation of its Pulse™ software platform at Hartley Bay, UBC and with Pacific Gas and Electric Company (PG&E).

Objectives:

- Provide tools to clarify and quantify results from energy management systems and to provide simple and direct feedback to utility customers to assist them in changing their energy usage habits, as well as in-depth analysis with individual customers.
- Enable the Pulse™ software deployment into any energy utility or building with minimal need for customization of the interface.
- Enhance the capability of the software and tools in order to support data storage, analysis, reporting and data security with extremely large data sets from utilities.

Results:

- Developed tools to assist energy and facility managers and utilities in interpreting results from their energy management systems by enabling users to view and analyze data from large portfolios of buildings as well as monthly energy forecasts including energy costs.
- Integrated Pulse™ software with customer information system (CIS) and meter data management system (MDMS); integrated the Pulse Enterprise Service Bus (ESB) with PG&E's MDMS system; implemented the Utility Program Manager (UPM) application; implemented advanced user interface and workflow features; implemented paper and email based energy reports in addition to customized reports.
- Enhanced large data handling capabilities and partnered with PG&E to conduct energy utility pilot program using ~60 meters, resulting in a cumulative savings of 0.38% against an anticipated savings of 1%.

Project Impacts:

- Pulse Energy management software helps reduce emissions of GHG's by facilitating the reduction of energy use by building owners, managers and utilities. GHG emissions reductions for the UBC demonstration were calculated to be 616 t CO_2e, and for the Hartley Bay demonstration were 781 t CO_2e. GHG emissions reductions for a small and a large building in Canada were calculated to be 0.44 t/CO_2e /bldg/yr and 69 t/CO2e/bldg/yr respectively. Similarly, GHG emissions reductions for a small and a large building in the rest of the world (ROW) were 0.85 t/CO_2e/bldg/yr and 133 t/CO_2e/bldg/yr.

Path to Market:

- Pulse intends to market the software directly, as well as through parent company Enernoc, to gas and electricity users for use with their commercial customers.
- Assuming successful application in Canada, the total number of small building installations would increase from 388 in 2014 to 327,000 in 2024 and the total number of large building installations would increase from 1,016 to 15,000 over the same years.
- Assuming successful application in the ROW, the total number of small building installations would increase from 43,500 in 2014 to 14,500,000 in 2024 and the total number of large building installations would increase from 145 to 600,000 over the same years.
- GHG emission reductions for installations are projected to be 1.2 Mt CO2e/yr in Canada and 92 Mt CO_2e/yr in the rest of the world by 2024.

Xogen Technologies Inc.

Round 14-2008B

Sector:
Waste Management

Project Delivery Completion:
October 2014

Market Impact Report Due:
October 2016

Total Project Value:
$4,250,776
(pending final audit)

SDTC Funding:
$1,974,104

Leveraged Funding:
$2,276,672

Consortium Members:
Xogen Technologies Inc.
Town of Orangeville
University of Toronto
Newalta Corp.
Orangeville Hydro Ltd.
Linde Canada Ltd.

Environmental Benefits:
(primary benefit bolded)
Clean Water
Clean Soil

Project Title:

Xogen's Pilot Plant

Project Description:

The Xogen process is an electrochemical wastewater treatment process which utilizes electrolysis to destroy organic pollutants. Screened raw sewage is pumped between a set of electrodes where highly oxidative species including ozone, hydrogen peroxide and hydroxyl radicals are generated. All reactions occur rapidly (within 10 minutes) and simultaneously in a single reactor such that all typical regulatory criteria including biological oxygen demand (BOD), suspended solids (SS), ammonia (NH3), total phosphorus (TP) and destruction of pathogens are achieved.

The SDTC project involved the design, fabrication and testing of a pilot plant to demonstrate Xogen's capabilities in achieving consistent effluent criteria. The project was initially conducted at the Town of Orangeville, Ontario's Water Pollution control plant, but moved to Newalta's Industrial Wastewater Treatment Site in Brantford, Ontario.

Objectives:

- The objective of the Orangeville portion of project was to demonstrate, at pilot scale, that the technology can achieve effluent criteria consistently and reliably at total life cycle costs which are lower than conventional biological treatment systems, while generating less sludge than the incumbent technology.
- The objective of the Newalta portion of the project was to demonstrate, at pilot scale, that the technology can lower the levels of chemical oxygen demand (COD) and total Kjeldahl nitrogen (TKN) of an industrial high-strength wastewater to 6,000 mg/L and 100 mg/L, respectively.

Results:

- Design and fabrication of the pilot plant and subsequent testing and optimization took place in the Orangeville Water Pollution control plant. Once transferred to the Newalta site, the technology was tested for a total of 136 days. The technology has the capability to remove conventional wastewater contaminants (BOD, SS, NH3, TP and pathogens) down to the levels typically required in effluent discharge regulations.
- Target levels of 6,000 mg/L and 100 mg/L for COD and TKN, respectively, were not achieved for these highly challenging and varying wastewaters and Xogen is currently working to address the issues encountered during the Orangeville and Newalta projects.

Project Impacts:

- Due to inconclusive results at both demonstration sites and the uncertainties around the potential market, it is not possible to provide a quantitative summary of the project benefits and the forecasted net impacts in the market rollout.

Path to Market:

- Xogen is currently evaluating several potential markets based on the findings in the demonstration project.

Section 5: SD Tech Fund™ – Approved Project Funding Summary Since Inception

Active Projects

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

*Project is contracted **Project is funded through the SD Natural Gas Fund ™ under which 50% of SDTC funding is contributed by CGA

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government and Academia Funding	% of Eligible Project Costs	Total Project Value	Environmental Benefits (Primary Benefits Bolded)			
Round 25-2014A											
**CHAR Technologies Inc.	$750,000	31.7%	$1,115,397	47.2%	$500,000	21.1%	$2,365,397	CC	**CA**		
CrossChasm Technologies Inc.	$430,000	33.4%	$858,856	66.6%	$0	0.0%	$1,288,856	**CC**	CA		
David Bromley Engineering Ltd.	$3,225,000	33.2%	$6,500,000	66.8%	$0	0.0%	$9,725,000	**CC**	CA		
Field Upgrading Ltd.	$5,150,000	27.4%	$6,820,063	36.3%	$6,820,063	36.3%	$18,790,126	**CC**	CA		
Fractal Systems Inc.	$3,700,000	32.3%	$7,772,221	67.7%	$0	0.0%	$11,472,221	**CC**			
Kelvin Storage Inc.	$2,830,936	32.1%	$5,997,637	67.9%	$0	0.0%	$8,828,573	**CC**	CA		
OTI Lumionics Inc.	$5,668,675	33.3%	$5,668,675	33.3%	$5,668,675	33.3%	$17,006,025	**CC**	CA		
Sigma Devtech Inc.	$3,100,000	29.6%	$5,967,875	56.9%	$1,422,255	13.6%	$10,490,130	**CC**			CS
SWITCH Materials	$2,500,000	28.5%	$6,277,532	71.5%	$0	0.0%	$8,777,532	**CC**	CA		
West Fraser Mills Ltd.	$6,100,000	32.8%	$9,481,707	51.0%	$3,000,000	16.1%	$18,581,707	**CC**	CA		
Round 24-2013B											
BBCP Conductor Inc.	$3,660,000	32.1%	$7,750,000	67.9%	$0	0.0%	$11,410,000	**CC**	CA		
CelluForce Inc.	$4,004,254	33.0%	$7,529,849	62.1%	$600,000	4.9%	$12,134,103	CC		**CW**	
GaN Systems Inc.	$2,187,971	33.0%	$3,442,244	51.9%	$1,000,000	15.1%	$6,630,215	**CC**	CA		
Grafoid Inc.	$8,120,646	32.9%	$15,097,622	61.1%	$1,500,000	6.1%	$24,718,268	**CC**	CA		
Ionada Inc.*	$1,100,000	31.7%	$1,953,181	56.2%	$420,000	12.1%	$3,473,181	CC	**CA**		
Miovision Technologies Inc.	$1,400,000	27.6%	$3,663,791	72.4%	$0	0.0%	$5,063,791	**CC**	CA		
OpenHydro Technology Canada Ltd.*	$6,352,500	18.9%	$27,233,449	81.1%	$0	0.0%	$33,585,949	**CC**	CA		
Polar Sapphire Ltd.	$2,650,000	33.2%	$5,334,937	66.8%	$0	0.0%	$7,984,937	**CC**	CA		
Questor Technology Inc.	$1,977,878	33.3%	$3,955,757	66.7%	$0	0.0%	$5,933,635	CC	**CA**		
Ranovus Inc.	$4,250,000	29.6%	$9,022,500	62.9%	$1,068,000	7.4%	$14,340,500	**CC**	CA		
Terramera Inc.	$1,984,581	33.3%	$3,969,961	66.7%	$0	0.0%	$5,954,542	CC	CA	CW	**CS**
Round 23-2013A											
Carbon Engineering Ltd. *	$3,000,000	32.8%	$4,523,118	49.4%	$1,626,723	17.8%	$9,149,841	**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	**CW**	CS

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 Eligible Project Costs	Total Project Value	Environmental Benefits (Primary Benefits Bolded)			
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	31.7%	$2,600,494	39.9%	$1,850,000	28.4%	$6,518,272	**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 Canada 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	27.1%	$2,488,090	30.5%	$3,455,000	42.4%	$8,148,629	**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											
Hifi Engineering Inc. *	$2,000,000	33.7%	$3,926,220	66.3%	$0	0.0%	$5,926,220			CW	**CS**
Luxmux Technology Corp.*	$980,350	32.5%	$1,049,367	34.8%	$985,542	32.7%	$3,015,259	**CC**	CA	CW	
Macrotek Inc. *	$1,953,700	33.3%	$3,912,580	66.7%	$0	0.0%	$5,866,280	CC	**CA**	CW	CS
Polymer Research Technologies	$1,116,826	33.3%	$2,233,652	66.7%	$0	0.0%	$3,350,478	CC			**CS**
Soilless Technology Inc.	$2,500,000	33.0%	$2,125,668	28.1%	$2,950,000	38.9%	$7,575,668	CC	CA	CW	**CS**
Solantro Semiconductor Corp. *	$3,800,000	33.0%	$7,716,019	67.0%	$0	0.0%	$11,516,019	**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	
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**
Round 21-2012A											
Airex Energie Inc. *	$2,700,000	32.4%	$3,008,030	36.1%	$2,631,092	31.6%	$8,339,122	**CC**	CA		
Borealis Geopower Inc. *	$2,379,962	29.1%	$5,807,383	70.9%	$0	0.0%	$8,187,345	**CC**	CA		
Diacarbon Energy Inc. *	$1,050,000	13.5%	$6,727,260	86.5%	$0	0.0%	$7,777,260	**CC**	CA		
Dundee Sustainable Technologies*	$8,000,000	18.4%	$35,513,594	81.6%	$0	0.0%	$43,513,594			CW	**CS**

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 Eligible Project Costs	Total Project Value	Environmental Benefits (Primary Benefits Bolded)			
NuWave Research Inc. *	$3,430,000	38.4%	$4,442,939	49.8%	$1,050,000	11.8%	$8,922,939	**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	
RB Energy Inc. *	$6,500,000	32.2%	$13,713,893	67.8%	$0	0.0%	$20,213,893	**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	CW	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	CW	**CS**
Round 20-2011B											
Agri-Neo Inc. *	$2,500,000	55.5%	$625,966	13.9%	$1,375,000	30.5%	$4,500,966			CW	**CS**
Atlantis Operations (Canada) Ltd. *	$5,000,000	32.7%	$10,296,788	67.3%	$0	0.0%	$15,296,788	**CC**	CA		
Développement Effenco Inc. *	$1,780,188	30.5%	$3,399,276	58.3%	$650,000	11.2%	$5,829,464	**CC**	CA		
GHGSat Inc. *	$2,317,648	32.7%	$2,656,296	37.5%	$2,118,081	29.9%	$7,092,025	**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	CW	**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	33.6%	$3,358,178	66.4%	$0	0.0%	$5,061,060	**CC**	CA		
semiosBIO Technologies Inc. *	$4,980,000	31.1%	$10,923,807	68.1%	$130,000	0.8%	$16,033,807			CW	**CS**
Solar Ship Inc. *	$2,180,000	36.1%	$3,865,647	63.9%	$0	0.0%	$6,045,647	**CC**	CA		
Whale Shark Environmental Technologies Ltd. *	$629,266	49.0%	$454,951	35.4%	$200,000	15.6%	$1,284,217	CC	CA	**CW**	
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	30.9%	$1,777,683	53.4%	$521,403	15.7%	$3,326,973	**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		
RER Hydro Ltd. *	$6,000,000	26.6%	$3,000,000	13.3%	$13,541,526	60.1%	$22,541,526	CC			
Vision Ecoproducts Ltd. *	$3,252,342	30.8%	$7,303,675	69.2%	$0	0.0%	$10,556,017	**CC**	CA		CS

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 Eligible Project Costs	Total Project Value	Environmental Benefits (Primary Benefits Bolded)			
Round 18-2010B											
BioAmber Sarnia Inc. *	$14,513,650	33.2%	$23,783,754	54.4%	$5,400,000	12.4%	$43,697,404	**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		CS
'Namgis First Nation*	$4,150,000	35.2%	$6,337,966	53.8%	$1,297,570	11.0%	$11,785,536			**CW**	
Northex Environnement Inc.	$1,552,354	38.8%	$1,588,720	39.7%	$857,175	21.4%	$3,998,249			CW	**CS**
Nova Green Inc. *	$1,098,905	33.9%	$970,000	29.9%	$1,177,356	36.3%	$3,246,261	**CC**			CS
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. *	$2,813,498	46.8%	$3,204,544	53.2%	$0	0.0%	$6,018,042	**CC**	CA		
Solantro 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. *	$5,435,750	33.3%	$10,873,138	66.7%	$0	0.0%	$16,308,888	**CC**	CA		
FibraCast*	$1,947,736	33.0%	$2,662,860	45.1%	$1,291,633	21.9%	$5,902,229	CC		**CW**	
S2G Biochemicals Inc. *	$2,616,952	33.9%	$3,851,969	49.9%	$1,251,336	16.2%	$7,720,257	**CC**		CW	
Temporal Power Ltd. *	$4,123,572	34.3%	$7,898,506	65.7%	$0	0.0%	$12,022,078	**CC**	CA		
Tyne Engineering Inc. *	$1,534,097	31.1%	$2,190,344	44.4%	$1,210,508	24.5%	$4,934,949		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											
EnerMotion Inc. *	$1,210,704	40.0%	$1,259,652	41.6%	$560,000	18.5%	$3,030,356	**CC**	CA		
Etalim Inc. *	$2,936,530	39.0%	$2,264,838	30.1%	$2,330,031	30.9%	$7,531,399	**CC**	CA	CW	CS
InvoDane Engineering Ltd. *	$2,467,125	28.0%	$6,329,998	72.0%	$0	0.0%	$8,797,123	**CC**			
MARA Renewables Corp.*	$9,614,045	35.0%	$17,854,655	65.0%	$0	0.0%	$27,468,700	**CC**	CA	CW	CS

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 Eligible Project Costs	Total Project Value	Environmental Benefits (Primary Benefits Bolded)			
MPT Mustard Products & Technologies Inc. *	$2,217,949	31.0%	$4,853,152	67.7%	$94,957	1.3%	$7,166,058		CA	CW	**CS**
Quadrogen Power Systems Inc. *	$2,910,145	39.1%	$3,477,831	46.7%	$1,053,245	14.2%	$7,441,221	**CC**	CA		
Tenova Goodfellow Inc. *	$1,822,513	29.5%	$4,346,389	70.5%	$0	0.0%	$6,168,902	**CC**			
Round 15-2009A											
Agrisoma Biosciences Inc. *	$3,275,000	30.2%	$7,428,340	68.5%	$145,000	1.3%	$10,848,340	CC	CA	CW	**CS**
Electrovaya 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	1.5%	$13,891,873	**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
Round 14-2008B											
Duropar 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		
MEG Energy Corp. *	$4,270,000	31.6%	$7,846,606	58.1%	$1,400,000	10.4%	$13,516,606	**CC**			
Soane Energy (Canada) Inc.*	$2,658,878	28.0%	$6,848,929	72.0%	$0	0.0%	$9,507,807	CC		**CW**	
Sunwell Technologies Inc. *	$2,779,849	39.0%	$4,340,464	61.0%	$0	0.0%	$7,120,313	**CC**	CA		
Round 13-2008A											
Alterna Energy Inc. *	$1,254,317	14.1%	$4,872,803	54.8%	$2,763,972	31.1%	$8,891,092	**CC**	CA	CW	
General Fusion Inc. *	$13,897,455	23.9%	$44,180,136	76.0%	$60,000	0.1%	$58,137,591	**CC**	CA		
GreenField Ethanol Inc. *	$3,927,964	30.3%	$5,034,928	38.8%	$4,000,686	30.9%	$12,963,578	**CC**	CA	CW	CS
Round 12-2007B											
Atlantec BioEnergy Corp. *	$1,833,482	34.7%	$3,244,927	61.4%	$202,650	3.8%	$5,281,059	CC	CA	CW	**CS**
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**		

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 Eligible Project Costs	Total Project Value	Environmental Benefits (Primary Benefits Bolded)			
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
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		
Total	**$408,358,372**	**27.5%**	**$898,981,495**	**60.6%**	**$175,157,289**	**11.8%**	**$1,482,497,156**				

Completed Projects

Note: Amounts are based on actual disbursements at project completion.

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 Eligible Project Costs	Total Project Value	Environmental Benefits (Primary Benefits Bolded)			
Round 19-2011A											
Pure Technologies Ltd.	$1,000,000	33.3%	$1,710,000	57.0%	$290,000	9.7%	$3,000,000	CC		**CW**	
Round 17-2010A											
Echologics Engineering Inc.	$1,051,926	32.7%	$1,794,785	55.8%	$370,679	11.5%	$3,217,390	CC		**CW**	CS
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											
Available Energy Corp.	$1,020,000	42.9%	$1,132,662	47.7%	$222,595	9.4%	$2,375,257	CC	CA	**CW**	
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**
Phostech Lithium Inc.	$4,700,508	27.8%	$12,210,547	72.2%	$0	0.0%	$16,911,055	**CC**	CA		
Round 15-2009A											
Automotive Fuel Cell Cooperation Corp.	$11,506,305	22.2%	$40,253,953	77.8%	$0	0.0%	$51,760,258	**CC**	CA		
Ballard Power Systems Inc.	$6,905,887	21.3%	$25,546,585	78.7%	$0	0.0%	$32,452,471	**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**
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	20.1%	$5,512,146	58.3%	$2,050,000	21.7%	$9,462,146	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		
RER Hydro Ltd.	$2,760,000	14.0%	$14,322,725	72.4%	$2,700,000	13.6%	$19,782,725	**CC**	CA		
Terragon Environmental Technologies Inc.	$3,174,000	39.6%	$2,239,827	28.0%	$2,592,598	32.4%	$8,006,425			**CW**	CS
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**		
Lignol Innovations Ltd.	$6,370,076	34.2%	$7,021,385	37.7%	$5,246,146	28.1%	$18,637,607	**CC**	CA		CS
Produits Enuchem Inc.	$595,000	39.7%	$904,904	60.3%	$0	0.0%	$1,499,904			CW	**CS**
Saltworks Technologies Inc.	$2,612,638	32.4%	$3,595,900	44.6%	$1,855,484	23.0%	$8,064,022	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		
Titanium Corp. Inc.	$6,292,635	29.1%	$13,554,184	62.6%	$1,795,970	8.3%	$21,642,789	CC		**CW**	CS
Xogen Technologies Inc.	$1,974,104	46.4%	$2,176,672	51.2%	$100,000	2.4%	$4,250,776			**CW**	CS

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 Eligible Project Costs	Total Project Value	Environmental Benefits (Primary Benefits Bolded)			
Round 13-2008A											
A.U.G. Signals Ltd.	$2,019,455	34.3%	$3,869,886	65.7%	$0	0.0%	$5,889,341	CC	CA	**CW**	
dPoint Technologies Inc.	$1,531,394	42.7%	$2,051,568	57.3%	$0	0.0%	$3,582,961	**CC**	CA		
EcoSynthetix Corp.	$1,679,331	33.0%	$1,612,596	31.7%	$1,796,955	35.3%	$5,088,882	**CC**	CA		
Innovente Inc.	$2,730,526	46.2%	$1,503,130	25.4%	$1,675,100	28.3%	$5,908,755	CC		CW	**CS**
Integran Technologies Inc.	$1,481,328	33.2%	$2,236,794	50.1%	$746,400	16.7%	$4,464,522	CC	**CA**	CW	
Nexterra Energy Corp.	$5,518,777	27.2%	$11,014,887	54.4%	$3,730,000	18.4%	$20,263,664	**CC**	CA		
Paragon Soil and Environmental Consulting Inc.	$230,879	43.8%	$296,242	56.2%	$0	0.0%	$527,122	CC	CA	CW	**CS**
SunCentral Inc.	$2,345,208	30.3%	$3,043,711	39.3%	$2,359,523	30.5%	$7,748,443	**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											
GaN Systems Inc.	$1,500,000	25.8%	$4,304,880	74.2%	$0	0.0%	$5,804,880	**CC**	CA		
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**	
Petroleum Technology Research Centre (Aquistore)	$5,000,000	18.2%	$13,473,745	49.0%	$9,000,000	32.8%	$27,473,745	**CC**			
Pure Technologies Ltd.	$795,000	31.7%	$1,133,335	45.2%	$580,000	23.1%	$2,508,335	CC	CA	**CW**	
Verdant Power Canada ULC	$487,324	40.6%	$472,178	39.3%	$240,844	20.1%	$1,200,346	**CC**	CA		
Western Hydrogen Ltd.	$4,162,653	32.2%	$8,755,346	67.8%	$0	0.0%	$12,917,999	**CC**	CA		
Round 11-2007A											
Corporation HET - Horizon Environnement Technologies	$1,509,807	23.4%	$4,431,590	68.8%	$500,000	7.8%	$6,441,396	CC		**CW**	CS
Développement Effenco Inc.	$1,074,955	28.3%	$2,093,388	55.1%	$633,456	16.7%	$3,801,799	**CC**	CA		
Fuseforward International Inc.	$400,000	26.2%	$679,343	44.6%	$444,578	29.2%	$1,523,921		CA	**CW**	CS
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	$1,506,082	30.7%	$1,256,989	25.6%	$2,139,386	43.6%	$4,902,456	**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		

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 Eligible Project Costs	Total Project Value	Environmental Benefits (Primary Benefits Bolded)			
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	32.5%	$7,585,036	67.5%	$0	0.0%	$11,230,327			**CW**	CS
SiREM ULC	$318,304	32.8%	$652,135	67.2%	$0	0.0%	$970,439	CC		**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 Biofuels 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**	
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		CS
Ostara Nutrient Recovery Technologies Inc.	$375,760	21.1%	$682,959	38.4%	$718,910	40.4%	$1,777,628	CC	CA	**CW**	CS
Power Measurement Ltd.	$2,960,871	32.5%	$5,893,795	64.7%	$250,000	2.7%	$9,104,666	**CC**	CA	CW	
Pure Technologies Ltd.	$2,200,000	32.2%	$3,858,424	56.4%	$782,138	11.4%	$6,840,562		CA	**CW**	CS
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**		
Wind Smart Inc.	$1,082,738	40.1%	$980,258	36.3%	$639,618	23.7%	$2,702,614	**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 Eligible Project Costs	Total Project Value	Environmental Benefits (Primary Benefits Bolded)			
Round 7-2005A											
EcoSmart Foundation Inc.	$1,499,143	48.8%	$1,453,483	47.3%	$119,389	3.9%	$3,072,015	**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	CW	
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		
Electrovaya 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%	$12,016,734	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		CS
Pratt & Whitney Canada Corp.	$5,368,257	32.0%	$10,831,080	64.6%	$576,463	3.4%	$16,775,800	CC	**CA**		
Science Applications International Corp. (SAIC Canada)	$1,009,588	20.8%	$246,143	5.1%	$3,590,824	74.1%	$4,846,555	**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		
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.	$551,462	7.6%	$6,589,080	90.7%	$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.	$3,322,440	30.0%	$6,337,962	57.2%	$1,417,145	12.8%	$11,077,548	**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			

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 Eligible Project Costs	Total Project Value	Environmental Benefits (Primary Benefits Bolded)			
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**		
Quantiam 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)	$2,414,610	21.7%	$8,714,998	78.2%	$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**			CS
Radient Technologies Inc.	$810,000	44.7%	$751,912	41.5%	$250,000	13.8%	$1,811,912	**CC**	CA		
University of New Brunswick	$257,826	35.5%	$325,228	44.8%	$142,457	19.6%	$725,511	**CC**	CA		
West Lorne Bio-Oil Co-Generation Ltd. Partnership	$5,000,000	40.9%	$7,015,947	57.4%	$200,000	1.6%	$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	**$294,935,171**	**26.4%**	**$682,110,354**	**61.0%**	**$141,185,716**	**12.6%**	**$1,118,231,237**				

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 Eligible Project Costs	Total Project Value	Environmental Benefits (Primary Benefits Bolded)			
Round 17-2010A											
Mining Technologies International Inc.	$46,743	21.7%	$168,821	78.3%	$0	0.0%	$215,564	CC	**CA**		
NIMTech Inc.	$326,778	46.7%	$197,660	28.2%	$175,562	25.1%	$700,000	**CC**		CW	
Round 16-2009B											
3XR Inc.	$516,976	28.9%	$646,068	36.1%	$624,524	34.9%	$1,787,568	CC		**CW**	
6574262 Canada Inc. (ICUS)	$102,400	33.7%	$201,554	66.3%	$0	0.0%	$303,954	CC		CW	**CS**
Gestion TechnoCap Inc., SpaceWatts Division	$840,000	31.2%	$1,136,140	42.2%	$718,168	26.7%	$2,694,308	**CC**	CA		
Spartan Bioscience Inc.	$923,992	14.5%	$5,030,810	79.2%	$400,000	6.3%	$6,354,802			**CW**	CS
Round 14-2008B											
Thermalfrost Inc.	$639,659	62.0%	$391,618	38.0%	$0	0.0%	$1,031,277	CC	**CA**		
Round 13-2008A											
Performance Plants Inc.	$651,400	33.5%	$1,293,077	66.5%	$0	0.0%	$1,944,476	CC		CW	**CS**
Round 12-2007B											
Aboriginal Cogeneration Corp.	$1,369,354	26.5%	$3,795,178	73.5%	$0	0.0%	$5,164,532	CC	CA	CW	**CS**
Alstom Hydro Canada Inc.	$1,396,351	29.3%	$3,370,582	70.7%	$0	0.0%	$4,766,932	**CC**	CA		
BioDiesel Reactor Technologies Inc.	$498,000	10.0%	$1,739,263	35.1%	$2,720,769	54.9%	$4,958,032	CC	CA	**CW**	CS
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.	$78,726	35.1%	$81,018	36.1%	$64,458	28.7%	$224,202	**CC**			
EnviroTower Inc.	$291,356	31.4%	$637,500	68.6%	$0	0.0%	$928,856	CC		**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											
Biogénie 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 Purenergy Inc.	$535,414	35.4%	$976,304	64.6%	$0	0.0%	$1,511,718	**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**		

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 Eligible Project Costs	Total Project Value	Environmental Benefits (Primary Benefits Bolded)			
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		
MinMiner Oilsands Inc.	$3,435,372	27.2%	$8,500,573	67.3%	$700,000	5.5%	$12,635,945	CC	CA	CW	**CS**
Zenon Membrane Solutions	$619,860	35.8%	$1,111,128	64.2%	$0	0.0%	$1,730,988	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	**CC**		CW	
Mechtronix Systems Inc.	$1,423,427	27.9%	$1,450,817	28.4%	$2,233,320	43.7%	$5,107,563	**CC**		CW	CS
Round 7-2005A											
AirScience Technologies Inc.	$375,895	28.2%	$956,224	71.8%	$0	0.0%	$1,332,119	**CC**	CA		
Dépôt Rive-Nord Inc.	$0	$0	$0	$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 Inc.	$915,205	28.1%	$1,240,905	38.1%	$1,100,000	33.8%	$3,256,110	CC	**CA**	CW	
Netistix 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.	$168,785	28.0%	$416,903	69.2%	$16,420	2.7%	$602,108	**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%	$1,826,418	51.4%	$840,119	23.6%	$3,555,669	**CC**			
Total	**$37,144,767**	**27.9%**	**$81,850,067**	**61.5%**	**$14,066,780**	**10.6%**	**$133,061,610**				

Section 6: SD Tech Fund™ – Classification of Projects Since Inception

SDTC Approved Funding in Hydrogen Economy, Clean Fossil Fuels, Clean Water and Clean Soil Projects
(as of December 31, 2014)

Hydrogen Economy Projects

Round	Lead Organization	Total Eligible Project Costs	Approved SDTC 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.	$ 51,760,258	$ 11,506,305
	Ballard Power Systems	$ 32,452,471	$ 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	$ 535,414
Round 8 - 2005B	Hydrogenics Corp.	$ 7,917,229	$ 2,248,493
Round 7 - 2005A	AirScience Technologies Inc.	$ 1,332,119	$ 375,895
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		**$ 195,264,916**	**$ 54,795,063**

Clean Fossil Fuel Projects

Round	Lead Organization	Total Eligible Project Costs	Approved SDTC Funding
Round 25 - 2014A	Fractal Systems Inc.*	$11,472,221	$3,700,000
	Field Upgrading Ltd.*	$18,790,126	$5,150,000
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.	$9,149,841	$3,000,000
	Inventys Thermal Technologies Inc.*	$9,492,458	$3,100,000
Round 22 - 2012B	Luxmux Technology Corp.	$3,015,259	$980,350
	Hifi Engineering Inc.	$5,926,220	$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
Round 20 - 2011B	MEG Energy Corp.	$147,637,763	$ 7,000,000
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

Clean Fossil Fuel Projects

Round	Lead Organization	Total Eligible Project Costs	Approved SDTC Funding
Round 14 - 2008B	MEG Energy Corp.	$ 13,516,606	$ 4,270,000
	Soane Energy (Canada) Inc.	$ 9,507,807	$ 2,658,878
	Statoil Hydro Canada Ltd.	$ 38,791,337	$ 6,000,000
	Titanium Corp. Inc.	$ 21,642,789	$ 6,292,635
Round 13 - 2008A	Paragon Soil and Environmental Consulting Inc.	$ 527,122	$ 230,879
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		**$ 456,026,751**	**$ 91,289,337**

Clean Water / Clean Soil Projects

Round	Lead Organization	Total Eligible Project Costs	Approved SDTC Funding
Round 24 - 2013B	CelluForce Inc.*	$12,134,103	$4,004,254
	Terramera Inc.*	$5,954,542	$1,984,581
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.	$5,926,220	$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
Round 21 - 2012A	Dundee Sustainable Technologies	$ 43,513,594	$8,000,000
	Polystyvert Inc.	$ 1,000,114	$480,000
	Yava Technologies Inc.*	$1,197,368	$399,123
Round 20 - 2011B	semiosBIO Technologies Inc.	$ 16,033,807	$4,980,000
	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	$2,500,000
Round 19 - 2011A	Pure Technologies Ltd.	$3,000,000	$1,000,000
Round 18 - 2010B	'Namgis First Nation	$ 11,785,536	$4,150,000
	Northex Environnement Inc.*	$3,998,249	$1,552,354
Round 17 - 2010A	Echologics Engineering Inc.	$ 3,217,390	$1,051,926

Clean Water / Clean Soil Projects

Round	Lead Organization	Total Eligible Project Costs	Approved SDTC Funding
	FibraCast	$ 5,902,229	$1,947,736
	Tyne Engineering Inc.	$4,934,949	$1,534,097
Round 16 - 2009B	3XR Inc.	$1,787,568	$516,976
	6574262 Canada Inc. (ICUS)	$303,954	$102,400
	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	$923,992
Round 15 – 2009A	Agrisoma Biosciences Inc.	$10,848,340	$3,275,000
	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	$9,462,146	$1,900,000
	SBI BioEnergy Inc.	$6,161,571	$1,875,495
	Terragon Environmental Technologies Inc.	$8,006,425	$3,174,000
Round 14 – 2008B	Produits Enuchem Inc.	$1,499,904	$595,000
	Duropar 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.	$9,507,807	$2,658,878
	Titanium Corp. Inc.	$21,642,789	$6,292,635
	Xogen Technologies Inc.	$4,250,776	$1,974,104
Round 13 – 2008A	A.U.G. Signals Ltd.	$5,889,341	$2,019,455
	Innoventé Inc.	$5,908,755	$2,730,526
	Paragon Soil and Environmental Consulting Inc.	$527,122	$230,879
	Performance Plants Inc.	$ 1,944,476	$ 651,400
	Vive Crop Protection Inc.	$ 11,038,603	$3,954,706
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.	$4,958,032	$498,000
	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	$6,441,396	$1,509,807
	Envirotower Inc.	$928,856	$291,356
	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	$ 11,230,327	$3,645,291

Clean Water / Clean Soil Projects			
Round	**Lead Organization**	**Total Eligible Project Costs**	**Approved SDTC Funding**
	SiREM Canada	$970,439	$318,304
	Terragon Environmenal Technologies Inc.	$4,097,783	$1,592,500
Round 9 - 2006A	MinMiner Oilsands Inc.	$12,635,945	$3,435,372
	Zenon Membrane Solutions	$1,730,988	$619,860
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		$510,520,059	$151,007,360

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

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 $589M 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 $151M 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 eighty five (285) funded projects:

- 90% of SDTC-funded projects have climate change benefits;
- 76% have clean air benefits;
- 42% 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, nearly 90% 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. CO_2e) are not currently available or in common use for clean air, clean water, or clean soil projects – either domestically or internationally. Consequently, SDTC has developed approaches for quantifying and reporting the benefits of clean air, clean water, and clean soil projects that accurately capture the value of SDTC investments in these areas.

CLIMATE CHANGE

The best conservative estimates of total annual GHG emissions reduction by 2015, ranges between 6 and 12 Megatonnes. The trend in GHG emissions reductions from SDTC portfolio projects is for considerable growth over the coming years. These figures include adjustments to account for the uncertainty of projections by applying a discounting factor to individual projects.[1]

Of the 119 SDTC funded projects completed prior to 2015, a total of 66 have climate change mitigation benefits and have reported actual annual GHG emissions reductions of approximately 4.5 Megatonnes CO_2e in 2014.

CLEAN AIR

A total of 100 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 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.

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 performarnance, 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.

Based on the new approach, SDTC has modeled the market roll-out impacts of the 100 projects. The results indicate that the avoided health impacts, or cost, for these SDTC projects would enable a discounted[2] avoided health related cost of over $1.2 billion by 2025[3]. In progressing towards these results, these 100 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 100 Clean Air projects by 2015

Contaminant	2015 (tonnes CAC emissions reduced per year)
PM	311[4]
NO_x	3,705
SO_x	3,515[5]
VOCs	165

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 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 32 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 annual water treatment or use cost of greater than $45M[6] by 2025. In progressing towards these benefits, the 32 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 PM emission reductions less than previously reported due to revised market achievements from key projects in this area.

5 SO_x emission reductions less than previously reported due to revised market achievements from 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 32 Clean Water projects by 2015

Benefits	
Water Conservation (m^3)	17,000,000[7]
Nitrogen Release Avoided (tonnes)	173
Phosphorus Release Avoided (tonnes)	36[8]

SDTC has recently implemented methodologies for estimating the benefits of 29 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 annual avoided cost greater than $263M[9] 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 29 Clean Soil projects by 2015

Benefits	
Landfill Avoidance (tonnes)	145,409
Landfill Avoidance ($CAN)	$5,800,000
Soil Treatment Avoidance ($CAN)	$72,000,000[10]
Soil Pollutant Emissions Reduction ($CAN)	$22,273[11]
Mining Project Impacts ($CAN)	$1,597,000[12]

7 Water conservation benefits less than previously resported due to delays in key projects in this area

8 Phosphorus reduction benefits less than previously reported due to delays in key projects in this area

9 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%.

10 Significant increase in benefits due to confirmation of market predictions.

11 Reduction in predicted benefits due to market delays in key projects

12 Reduction in predicted benefits due to market delays in key projects

Section 7: SD Tech Fund™ – Portfolio Since Inception By Region

Lead Organization	Province	SDTC Funds	Total Eligible Project Costs
Atlantic Canada			
6574262 Canada Inc. (ICUS)	Newfoundland	$102,400	$303,954
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	$15,296,788
Bio Vision Technology Inc.	Nova Scotia	$749,848	$2,608,575
CarbonCure Technologies Inc.	Nova Scotia	$1,192,000	$3,282,283
Green Power Labs Inc.	Nova Scotia	$1,650,000	$5,572,029
MARA Renewables Corp.	Nova Scotia	$9,614,045	$27,468,700
Nova Scotia Power Inc.	Nova Scotia	$4,650,000	$11,704,996
OpenHydro Technology Canada Ltd.	Nova Scotia	$6,352,500	$33,585,949
University of New Brunswick	New Brunswick	$257,826	$725,511
Total		**$33,499,049**	**$112,723,392**
Quebec			
Agri-Neo Inc.	Quebec	$2,500,000	$4,500,966
Agrisoma Biosciences Inc.	Quebec	$3,275,000	$10,848,340
Airex Energie Inc.	Quebec	$2,700,000	$8,339,122
AirScience Technologies Inc.	Quebec	$375,895	$1,332,119
Alcoa Ltd.	Quebec	$170,958	$599,845
Alstom Hydro Canada Inc.	Quebec	$1,396,351	$4,766,932
Alternative Green Energy Systems Inc.	Quebec	$517,041	$1,761,928
BioAmber Sarnia Inc.	Quebec	$14,513,650	$43,697,404
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	$200,487	$600,487
Biothermica Technologies Inc.	Quebec	$78,726	$224,202
CelluForce Inc.	Quebec	$4,004,254	$12,134,103
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	$6,441,396
CRB Innovations Inc.	Quebec	$5,362,500	$15,245,384

Lead Organization	Province	SDTC Funds	Total Eligible Project Costs
CVTCORP Transmission Inc.	Quebec	$1,027,887	$3,326,973
CVTCORP Transmission Inc.	Quebec	$2,131,950	$7,649,865
Dépôt Rive-Nord Inc.	Quebec	$0	$0
Développement Effenco Inc.	Quebec	$1,074,955	$3,801,799
Développement Effenco Inc.	Quebec	$1,780,188	$5,829,464
Dundee Sustainable Technologies	Quebec	$8,000,000	$43,513,594
Early Warning Inc.	Quebec	$2,068,041	$6,137,455
Enerkem Technologies Inc.	Quebec	$720,573	$2,253,418
Enerkem Technologies Inc.	Quebec	$2,660,476	$17,147,261
Envirogain Inc.	Quebec	$957,623	$2,210,205
Ferrinov Inc.	Quebec	$1,083,366	$5,434,975
Fractal Systems Inc.	Quebec	$3,700,000	$11,472,221
Gestion TechnoCap Inc., SpaceWatts Division	Quebec	$840,000	$2,694,308
GHGSat Inc.	Quebec	$2,317,648	$7,092,025
Innovente inc.	Quebec	$2,730,526	$5,908,755
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	$1,423,427	$5,107,563
Nanox Inc.	Quebec	$1,774,548	$4,437,796
Nemaska Lithium Inc.	Quebec	$12,870,000	$40,095,000
Northex Environnement Inc.	Quebec	$1,552,354	$3,998,249
NutraCanada	Quebec	$1,900,000	$9,462,146
Orbite Aluminae Inc.	Quebec	$4,500,000	$14,043,310
Phostech Lithium Inc.	Quebec	$4,700,508	$16,911,055
Polystyvert Inc.	Quebec	$480,000	$1,000,114
Produits Enuchem Inc.	Quebec	$595,000	$1,499,904
RER Hydro Ltd.	Quebec	$2,760,000	$19,782,725
RER Hydro Ltd.	Quebec	$6,000,000	$22,541,526
Sigma Devtech Inc.	Quebec	$3,100,000	$10,490,130
SiXtron Advanced Materials	Quebec	$1,331,823	$6,464,802
St-Jean Photochemicals	Quebec	$1,506,082	$4,902,456
Sunarc of Canada Inc.	Quebec	$545,357	$1,819,222

Lead Organization	Province	SDTC Funds	Total Eligible Project Costs
Sysgaz Inc.	Quebec	$2,205,539	$8,148,629
Terragon Environmental Technologies Inc.	Quebec	$1,592,500	$4,097,783
Terragon Environmental Technologies Inc.	Quebec	$3,174,000	$8,006,425
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		**$138,909,203**	**$488,908,317**
Ontario			
3XR Inc.	Ontario	$516,976	$1,787,568
A.U.G. Signals Ltd.	Ontario	$2,019,455	$5,889,341
Accelerated Systems Inc.	Ontario	$1,400,000	$4,000,624
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	$498,000	$4,958,032
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
Canadian Pallet Council	Ontario	$1,058,755	$2,428,338
CHAR Technologies Inc.	Ontario	$750,000	$2,365,397
Chinook Mobile Heating and De-icing Inc.	Ontario	$3,063,766	$7,378,282
Cleeve Technology Inc.	Ontario	$710,000	$2,200,000
CrossChasm Technologies Inc.	Ontario	$430,000	$1,288,856
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	$5,435,750	$16,308,888
Echologics Engineering Inc.	Ontario	$1,051,926	$3,217,390
EcoSynthetix Corp.	Ontario	$1,679,331	$5,088,882
EcoSynthetix Corp.	Ontario	$2,100,000	$6,381,875
EcoVu Analytics Inc.	Ontario	$1,035,555	$3,165,715

Lead Organization	Province	SDTC Funds	Total Eligible Project Costs
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	$1,210,704	$3,030,356
Ensyn Technologies Inc.	Ontario	$2,000,000	$8,895,871
Entropex Ltd.	Ontario	$6,330,000	$25,024,389
EnviroTower Inc.	Ontario	$291,356	$928,856
FibraCast	Ontario	$1,947,736	$5,902,229
Fifth Light Technology Ltd.	Ontario	$3,036,000	$9,200,000
Fifth Light Technology Ltd.	Ontario	$3,911,300	$12,836,640
GaN Systems Inc.	Ontario	$2,187,971	$6,630,215
GaN Systems Inc.	Ontario	$1,500,000	$5,804,880
General Electric Canada (Locomotive)	Ontario	$3,903,394	$11,721,903
General Electric Canada (Microgrid)	Ontario	$2,485,395	$7,456,183
Grafoid Inc.	Ontario	$8,120,646	$24,718,268
GreenField Ethanol Inc.	Ontario	$3,927,964	$12,963,578
GreenMantra Technologies	Ontario	$2,007,450	$6,083,181
Hydrogenics Corp.	Ontario	$1,350,419	$3,069,135
Hydrogenics Corp.	Ontario	$2,248,493	$7,917,229
Hydrostor Inc.	Ontario	$2,171,011	$5,867,597
Imtex Membranes Corp.	Ontario	$2,753,948	$8,735,378
Integran Technologies Inc. (Morph)	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
Ionada Inc.	Ontario	$1,100,000	$3,473,181
Kelvin Storage Inc.	Ontario	$2,830,936	$8,828,573
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	$5,866,280
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	$46,743	$215,564
Miovision Technologies Inc.	Ontario	$1,400,000	$5,063,791

Lead Organization	Province	SDTC Funds	Total Eligible Project Costs
Morgan Solar Inc.	Ontario	$2,351,580	$9,299,472
Morgan Solar Inc.	Ontario	$2,067,778	$6,518,272
Netistix Technologies Corp.	Ontario	$471,199	$1,169,206
NIMTech Inc.	Ontario	$326,778	$700,000
OTI Lumionics Inc.	Ontario	$5,668,675	$17,006,025
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
Polar Sapphire Ltd.	Ontario	$2,650,000	$7,984,937
Pratt & Whitney Canada Corp.	Ontario	$5,368,257	$16,775,800
PV Labs Inc.	Ontario	$965,253	$2,953,044
Ranovus Inc.	Ontario	$4,250,000	$14,340,500
RB Energy Inc.	Ontario	$6,500,000	$20,213,893
Science Applications International Corp. (SAIC Canada)	Ontario	$1,009,588	$4,846,555
SiREM ULC	Ontario	$318,304	$970,439
Solantro Semiconductor Corp.	Ontario	$2,049,234	$7,106,664
Solantro Semiconductor Corp.	Ontario	$3,800,000	$11,516,019
Solar Ship Inc.	Ontario	$2,180,000	$6,045,647
Spartan Bioscience Inc.	Ontario	$923,992	$6,354,802
Sunwell Technologies Inc.	Ontario	$2,779,849	$7,120,313
Temporal Power Ltd.	Ontario	$4,123,572	$12,022,078
Tenova Goodfellow Inc.	Ontario	$3,322,440	$11,077,548
Tenova Goodfellow Inc.	Ontario	$1,822,513	$6,168,902
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	$487,324	$1,200,346
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

Lead Organization	Province	SDTC Funds	Total Eligible Project Costs
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	$4,250,776
Yava Technologies Inc.	Ontario	$399,123	$1,197,368
ZENON Environmental Inc.	Ontario	$1,760,000	$5,334,000
Zenon Membrane Solutions	Ontario	$619,860	$1,730,988
Total		**$231,095,414**	**$802,748,139**
Prairies			
Aboriginal Cogeneration Corp.	Manitoba	$1,369,354	$5,164,532
Borealis Geopower Inc.	Alberta	$2,379,962	$8,187,345
bstNRG.com Inc. (formerly Vidir Biomass Inc.)	Manitoba	$1,651,169	$3,669,264
Carbon Engineering Ltd.	Alberta	$3,000,000	$9,149,841
Eco-Ag Initiatives Inc.	Alberta	$1,948,000	$5,791,615
Field Upgrading Ltd.	Alberta	$5,150,000	$18,790,126
Great Northern Power Corp.	Alberta	$551,462	$7,265,541
Hifi Engineering Inc.	Alberta	$2,000,000	$5,926,220
Highmark Renewables Inc.	Alberta	$1,000,000	$7,056,245
Himark bioGas Inc.	Alberta	$3,331,976	$10,303,057
HTC Purenergy Inc.	Saskatchewan	$535,414	$1,511,718
Lancaster Wind Systems Inc.	Alberta	$566,194	$1,637,200
Luxmux Technology Corp.	Alberta	$980,350	$3,015,259
MEG Energy Corp.	Alberta	$4,270,000	$13,516,606
MEG Energy Corp.	Alberta	$7,000,000	$147,637,763
Milligan Biofuels Inc.	Saskatchewan	$7,004,493	$28,141,614
MinMiner Oilsands 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	$1,098,905	$3,246,261
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	$230,879	$527,122
Petroleum Technology Research Centre (Aquistore)	Saskatchewan	$5,000,000	$27,473,745

Lead Organization	Province	SDTC Funds	Total Eligible Project Costs
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	$2,200,000	$6,840,562
Pure Technologies Ltd.	Alberta	$795,000	$2,508,335
Pure Technologies Ltd.	Alberta	$1,000,000	$3,000,000
Pure Technologies Ltd.	Alberta	$1,000,000	$3,015,000
Quantiam Technologies Inc.	Alberta	$1,450,000	$9,844,819
Questor Technology Inc.	Alberta	$1,977,878	$5,933,635
R.I.I. North America Inc.	Alberta	$2,496,508	$8,321,692
Radient Technologies Inc.	Alberta	$810,000	$1,811,912
Saskatchewan Power Corp. (SaskPower)	Saskatchewan	$2,414,610	$11,149,608
SBI BioEnergy Inc.	Alberta	$1,875,495	$6,161,571
Soane Energy (Canada) Inc.	Alberta	$2,658,878	$9,507,807
Soilless 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
Synodon Inc.	Alberta	$1,056,790	$4,572,871
Titanium Corp. Inc.	Alberta	$6,292,635	$21,642,789
Venmar CES Inc.	Saskatchewan	$1,990,000	$6,625,748
Verolube Inc.	Alberta	$3,994,060	$12,143,500
West Fraser Mills Ltd.	Alberta	$6,100,000	$18,581,707
Western Hydrogen Ltd.	Alberta	$4,162,653	$12,917,999
Western Hydrogen Ltd.	Alberta	$1,480,000	$4,492,123
Whitefox Technologies Canada Ltd.	Alberta	$2,608,545	$6,983,099
Total		**$137,755,786**	**$617,530,664**
British Columbia			
Advanced Lithium Power Inc.	British Columbia	$1,400,000	$5,534,876
Alterna 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	$11,506,305	$51,760,258
Ballard Power Systems Inc.	British Columbia	$6,905,887	$32,452,471
Ballard Power Systems Inc.	British Columbia	$7,304,367	$21,238,984
BBCP Conductor Inc.	British Columbia	$3,660,000	$11,410,000

Lead Organization	Province	SDTC Funds	Total Eligible Project Costs
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
David Bromley Engineering Ltd.	British Columbia	$3,225,000	$9,725,000
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	$1,499,143	$3,072,015
Etalim Inc.	British Columbia	$2,936,530	$7,531,399
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	$58,137,591
HTEC Hydrogen Technology & Energy Corp.	British Columbia	$5,001,074	$13,891,873
IBC Technologies Inc.	British Columbia	$168,785	$602,108
InvenTyS Thermal Technologies Inc.	British Columbia	$1,598,001	$3,914,947
Inventys Thermal Technologies Inc.	British Columbia	$3,100,000	$9,492,458
Lignol Innovations Ltd.	British Columbia	$6,240,816	$20,325,922
Lignol Innovations Ltd.	British Columbia	$6,370,076	$18,637,607
M.A. Turbo/Engine Ltd.	British Columbia	$152,844	$332,604
Middle Bay Sustainable Aquaculture Institute	British Columbia	$3,645,291	$11,230,327
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	$11,785,536
Nexterra Energy Corp.	British Columbia	$1,159,518	$3,513,692
Nexterra Energy Corp.	British Columbia	$5,518,777	$20,263,664
Nutriloc Ingredients Corp.	British Columbia	$847,319	$2,404,493
NuWave Research Inc.	British Columbia	$3,430,000	$8,922,939
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

Lead Organization	Province	SDTC Funds	Total Eligible Project Costs
Power Diagnostic Technologies Ltd.	British Columbia	$1,191,107	$3,489,382
Power Measurement Ltd.	British Columbia	$2,960,871	$9,104,666
Power Measurement Ltd.	British Columbia	$1,702,882	$5,061,060
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	$2,616,952	$7,720,257
Sacré-Davey Innovations	British Columbia	$5,727,711	$17,681,710
Saltworks Technologies Inc.	British Columbia	$2,612,638	$8,064,022
Saltworks Technologies Inc.	British Columbia	$2,500,000	$7,500,000
Segetis Canada Inc.	British Columbia	$15,000,000	$83,000,000
semiosBIO Technologies Inc.	British Columbia	$4,980,000	$16,033,807
Shipstone Corp.	British Columbia	$2,813,498	$6,018,042
SunCentral Inc.	British Columbia	$2,345,208	$7,748,443
SunSelect Produce (Delta) Inc.	British Columbia	$1,672,425	$5,609,006
SWITCH Materials Inc.	British Columbia	$2,500,000	$8,777,532
SWITCH Materials Inc.	British Columbia	$2,363,621	$8,046,780
Tantalus Systems Corp.	British Columbia	$2,981,310	$10,102,523
Terramera Inc.	British Columbia	$1,984,581	$5,954,542
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		**$199,178,858**	**$711,879,491**

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 Funds section of the SDTC website at: www.sdtc.ca

Section 9: NextGen BioFuels Fund™ – Portfolio Since Inception

In 2014 a continued trend of slow deployment of next generation biofuel technologies at commercial scale was observed globally. Low cost crude oil, natural gas, and the exploitation of shale oil reserves in the United States also adversely impacted the commercial demonstration of biofuel technology platforms. A small number of commercial plants were constructed in 2014 primarily in the United States. In addition, Canadian projects are also planned.

In 2014 the Next Generation Biofuels Fund (NGBF) transitioned to a project construction focus. Despite the above noted trends, as of January 30, 2015 two projects, the Enerkem Alberta Biofuels Project and the AE Côte-Nord RTP™ Project were approved for final funding commitments by the SDTC Board of Directors. Total project costs pertaining to the two projects amount to $246.2.M with NGBF funding totaling $90.6M. Details regarding the two approved projects are noted below. In 2014 five applications for funding (AFFs) were received representing total project costs of $569.4M.

Currently, the SDTC NextGen Biofuels Fund (NGBF) is in its wind down phase. Due to remaining time constraints, AFFs received in 2014 will likely be the last to receive consideration for project funding.

Projects

Enerkem Alberta Biofuels Project

Total Project Costs*:
$174.5M
Approved Final SDTC Contribution:
$63.6M
SDTC Contribution To Date:
$734,000

Enerkem Inc. intends to build, own, and operate a commercial next generation cellulosic ethanol plant capable of converting 100,000 Bone Dry Metric Tons (BDMT) of sorted Municipal Solid Waste (MSW) into 38 million litres of cellulosic ethanol. The Project will utilize thermochemical gasification process technology developed by Enerkem and is sited adjacent to the City of Edmonton Integrated Waste Management Centre (EWMC). In addition to producing ethanol the facility will have the capability to provide bio-methanol as a co-product.

Partners
Enerkem Inc.

AE Côte-Nord RTP™ Project

Total Project Costs*:
$71.7M
Approved Final SDTC Contribution:
$27M
Approved SDTC Contribution To Date:
$449,000

The AE Côte-Nord RTP™ Project will employ Ensyn Technologies' fast pyrolysis process to convert wood and woody materials into a liquid fuel product. Renewable Fuel Oil ("RFO"), produced by the Project will be substituted for fossil derived fuel oil in industrial and institutional applications. The project will be located on the existing Arbec Port Cartier Sawmill site and will be capable of processing 36,400 BDMT of feedstock into 21 M liters of RFO annually.

Partners
Ensyn Bioenergy Canada Inc.
Arbec Forest Products Inc.

For NGBF Funding process, see the Funds section of the SDTC webside at: www.sdtc.ca.